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1913. VOL. XXVII. 1914.

THE

OTTAWA NATURALIST

Being Volume XXIX of the

TRANSACTIONS

OF THE

OTTAWA FIELD-NATURALISTS' CLUB

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Organized March, 1879. Incorporated March, 1884.

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LIST OF MEMBERS OF THE OTTAWA FIELD-NATURALISTS' CLUB

1913-1914

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Henry, J. K., (Vancouver, B.C.)
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McCready, *Prof.* S. B., (Guelph, Ont.)
McDougall, Miss J. C.

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McMillan, H. R., *B.S.A.*
McMillan, G. A., *M.A.*
McMillan, Thos., (Seaforth, Ont.)
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Scott, Miss Mary McKay.
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Smith, Harlan I.
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Symes. P. B.

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Terrill, L. M., (St. Lambert, Que.)
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Walker, Bryant, (Detroit).
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White, George, R.
White, James, (Snelgrove, Ont.)
White, J. F., *M.A.*, *LL.D.*
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Whyte, Miss Isabella.
Whyte, R. B.
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Wight, E. C.
Williams, Miss M. B., *B.A.*
Williams, J. B., (Toronto).
Williams, N.Y.
Willing, T. N., (Saskatoon, Sask.)
Wilson, Morley, E.
Wilson, W. J., *Ph.B.*
Wilson, E., (Armstrong, B.C.)
Winchester, H. S.

Young, A. N.
Young, C. H.

Ziemann, Arthur.

CORRESPONDING MEMBERS.

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GREENE, DR. E. L. ,United States National Museum, Washington, D.C.
HILL, ALBERT J., *M.A.*, *C.E.*, New Westminster, B.C.
HOLM, THEODOR, *Ph.D.*, Brookland, Washington, D.C.
MERRIAM, DR. C. HART, Department of Agriculture, Washington, D.C.
WICKHAM, PROF. H. F., Iowa City, Iowa, U.S.

THE OTTAWA NATURALIST

Vol. XXVII. APRIL, 1913 No. 1

ANNUAL REPORT OF THE OTTAWA FIELD-NATURALISTS' CLUB, 1912-13.

During the past year a good deal of quiet, steady work has been done by the officers and members of the Club. The Council has held six meetings during the year. The following is a brief synopsis of its work. At the first the various committees were appointed, and arrangements were made for an extra lecture by Mr. C. Leden on "Our Neighbours of the North." At the second the spring outings were arranged for, a delegate was appointed to attend the meetings of the Royal Society in May, and a committee of four was appointed to consider the advisability of publishing the Constitution. This, as you have seen, was done in the October number of The Ottawa Naturalist. In September a meeting was held to arrange for some fall excursions. At this meeting twelve new members were elected. At the next meeting the programme of winter lectures, as proposed by the indefatigable chairman of the Lectures Committee, was received and ordered to be printed. And, at the last meeting the reports of several committees and branches were received, and a vast amount of routine work dealt with, including some valuable suggestions for the next Council, and the election of seven more members.

Membership.

In all 21 new members have been elected, 12 have resigned, leaving a total of 330 members now on the books. One of the corresponding members, the Rev. G. W. Taylor, has died, as reported in the September issue of The Ottawa Naturalist.

Publications Committee.

As no matters of a sufficiently important nature to warrant the calling together of the Committee arose during the past year no special meetings were held. The chief work of the Committee, namely, the publication of The Ottawa Naturalist, has proceeded very satisfactorily, thanks to the careful work of our Editor, Mr. Arthur Gibson, to whom we wish to express our indebtedness and appreciation of the regular manner in which our journal has appeared. It has contained a number of interesting and important papers which have not been confined to our local fauna and flora.

The Librarian, Mr. A. E. Currie, has arranged the back issues of THE OTTAWA NATURALIST so that we now know definitely what numbers are available.

The report of the Librarian is as follows:—

A short while ago the surplus copies of THE OTTAWA NATURALIST, issued since April, 1910, were transferred from the residence of Mr. Arthur Gibson to the Osgoode St. School, and placed along with the older numbers.

About a year and a half ago, while first arranging the back numbers of the NATURALIST in an accessible position, there were five parcels found, each bearing the legend, "Nos. required to complete this set, Sept., 1891; April, 1892; Jan., 1895; Feb., 1895, and March, 1896." Recently, while examining these parcels and loose numbers more closely, it was found that the five numbers were never issued. There are, therefore, five complete sets of THE OTTAWA NATURALIST still available and no doubt at least another two sets could be compiled from the loose numbers.

During the year the various publications received through exchange have been placed, with the library of the Club, on the north-west stack of the second floor of the Carnegie Library.

EXCURSIONS COMMITTEE.

As the experience of the preceding season seemed to indicate that a programme of fortnightly excursions did not give a sufficient number of excursions after the deduction of those inevitably cancelled through bad weather or other unforeseen circumstances, it was decided to revert to the practise, previously followed by the Club, of holding an excursion every week during the earlier part of the season. A programme of weekly excursions was accordingly arranged for. The first excursion was on April 27th to Beechwood, and the two succeeding ones on May 4th and May 11th to Blueberry Point and Britannia respectively. Notwithstanding the backward season these were well attended and in every way successful. Detailed reports of them will be found in THE OTTAWA NATURALIST.

An excursion was held on Saturday, June 1st, to Chelsea, at which several leaders and a large number of members took part. While waiting for the return train the leaders gave an instructive account of the botanical and geological specimens that were observed and studied. No account of this was published.

The excursion to Ironsides on June 8th was spoiled by a deluge of rain, which rendered it impossible to make observations. On June 22nd a few members held an enthusiastic and successful excursion to the Mer Bleue.

On October 5th an excursion was held to the Experimental Farm, but, owing perhaps to the lateness of the date, only a small number of members attended. And the following Saturday a small but very enthusiastic party did some explorations near MacKay's Lake. It would seem that if the attempt to revive fall excursions is to be successful they must be arranged for dates a little earlier in the season.

LECTURES COMMITTEE.

During the winter season five public lectures were held, all of which were well attended. All of the lectures were held in the Assembly Hall of the Normal School.

The following printed programme was carried out:—

November 29, 1912—"School Gardens as a Factor in Education," Prof. H. L. Hutt, B.S.A., Professor of Horticulture and Landscape Gardening, Ontario Agricultural College, Guelph, Ont.

December 10th, 1912—"Short Talks on Local Natural History," by members of the Club.*

January 28th, 1913—"Modern Museum Work for the Scientist, the Teacher and the Public," Mr. Harlan I. Smith, Archæologist, Geological Survey, Ottawa.

February 11th, 1913—"Heredity: Its Meaning and Application," C. Gordon Hewitt, D.Sc., Dominion Entomologist, Central Experimental Farm, Ottawa.

February 25th—"Some Conditions of Progress in the Plant World," Prof. W. T. MacClement, D.Sc., Professor of Botany, Queen's University, Kingston, Ont.

March 18th, 1913—ANNUAL MEETING. President's Address. L. H. Newman, B.S.A., Secretary, Canadian Seed Growers' Association, Ottawa. (Carnegie Library).

In addition to these there was one lecture in the spring, shortly after the last annual meeting. It was delivered by Mr. Christian Leden, on the Esquimaux, and was illustrated by views, and also by phonographic reproductions of their weird music.

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*At the meeting on December 10th, the following members took part: J. W. Gibson, "On some Problems in Animal Ecology, with special reference to Insects"; (2) J. W. Eastham, "The Life History of a Slime Mould, and Notes on some Ottawa species"; (3) E. E. Lemieux, "Notes from Blueberry Point, and Observations on Fish and Game on the Petewawa"; (4) J. M. Swaine, "Some Forest Insects in Clark's Bush"; (5) F. E. Buck, "The Rose".

BOTANICAL BRANCH.

There have been eight meetings of this branch held during the past year. Two meetings have been held at the residences of the following members: Messrs. W. T. Macoun, R. B. Whyte and G. H. Clark; and one at the residences of Messrs. A. E. Attwood and J. J. Carter. A synopsis of three of these have been published, one will appear next month, and one will be published in full. It is hoped that a report of the other meetings will be obtained and published.

The subjects presented at these meetings were: Problems in Horticulture of Interest to Botanists, by W. T. Macoun; A Summer in Britain, illustrated with lantern slides, by R. B. Whyte; Nature Study of Plants in Relation to their Identification, by Dr. M. Oscar Malte; The Ottawa Flora from an Ecological Point of View, by J. M. Macoun; A Trip to Bermuda in January, by R. B. Whyte; Common Fungi on Wood, by J. W. Eastham; Elevator Screenings as a Means of Plant Dispersal, by J. R. Dymond; The Shade Trees of Ottawa, by Dr. E. H. Blackader; The Effect of Temperature on Fruit and Trees, by W. T. Macoun; Hardiness from a Physiological Standpoint, by L. H. Newman.

The attendance has been good and the interest sustained at all these meetings.

ENTOMOLOGICAL BRANCH.

During the past year considerable field work was accomplished by members interested in this branch of the Club's activities. Large numbers of insects were collected throughout the Ottawa District and some of these have been found to be new to science. Certain groups were sought after particularly, and many of these have been determined, and definite records for the locality obtained.

The most important outbreak of an insect which has occurred for many years was that of the Forest Tent Caterpillar, *Malacosoma disstria*, which devastated miles of forest country in the Gatineau Valley, north of Ironsides. The foliage of certain trees, particularly poplar and birch, was entirely eaten by the caterpillars and for a certain period the trains leaving Ottawa for Kazabazua and Maniwaki were unable to make the grade between Ironsides and Chelsea, owing to the thousands of caterpillars which were present on the rails.

The Treasurer's report shows a balance on hand of $9.79.

The thanks of the Club are due to Principal White for the use of the Normal School Hall, to the Library Board and the Librarian of the Carnegie Library for the use of the lecture and committee rooms on several occasions, to the gentlemen who have so kindly and willingly assisted us in our course of winter lectures, and to the press of the city for the free insertion of notices of meetings and publication of the lectures and excursions of the Club.

All of which is respectfully submitted,

E. H. Blackader,
Secretary.

Treasurer's Statement for Year Ending 18th March, 1913.

Receipts.

Balance from year 1911-12		$ 13.85
Subscriptions:		
Arrears	$ 34.00	
1912-13	178.45	
1913-14	26.00	
		238.45
Advertisements in Ottawa Naturalist		109.50
Ottawa Naturalist sold		.15
Author's Extras sold		16.20
Government Grant		200.00
		$578.15

Expenditure.

Printing Ottawa Naturalist, Vol. XXVI, nine numbers with covers	$342.76	
Illustrations	18.22	
Author's Extras	46.30	
Miscellaneous Printing: circulars, mailing envelopes, etc	32.76	
	$440.04	
Postage on Ottawa Naturalist	33.14	
Editor	50.00	
		523.18
Lecture expenses		24.82
Sundry Expenses: postage, envelopes, etc		20.36
Balance		9.79
		$578.15

W. T. Macoun,
Treasurer.

Examined and found correct,
J. Ballantyne,
E. C. Wight,
Auditors.

MEETINGS OF THE BOTANICAL BRANCH.

Feb. 1st, at the residence of Mr. R. B. Whyte, members present: Messrs. F. E. Buck, L. H. Newman, F. Jones, W. T. Macoun, G. O. McMillan, W. Dreher, E. D. Eddy, A. E. Attwood, J. J. Carter, G. H. Clark, J. R. Dymond, C. J. Tully, Dr. Blackader and the host, Mr. Whyte, who gave a very interesting account of his impressions of Bermuda after a short visit there in January.

The Bermudas consist of five large islands, bridged together, viz.: Bermuda, St. George, St. Davids, Somerset and Ireland. The total length is 25 miles, and from half to three wide. The highest point is 260 feet above tidewater. To the north-west there is a long, low coral reef, and the entrance to the harbor is from the east. One of the pleasure trips is to take a glass-bottomed boat and go out towards the reef, and see the marine organisms at a depth of 5 to 50 feet below through the clear water. The temperature of the water is 71°.

Bermuda is entirely of coral formation, resting on a substratum of limestone. The temperature in January was 65-68°. The minimum for the year is 57° and the maximum 80°. The rain falls on an average 200 days in the year, with a total rain-fall of 65 or 70 inches. Nearly all the drinking water is collected from the roofs of the houses, and conducted and stored in cemented cisterns. Some few wells are sunk into the coral rock, but if sunk too deep the water is salty.

The total area is 12,378 acres, of which 2,300 is in cultivation; of this 1,000 is good, 1,000 fair, and 300 poor. Agriculture is very primitive. The farms are all small, and cultivation is done mostly by hand and with the spade, quickly followed by the rake. The soil is red and very friable, and has to be fertilized after every second or third crop. The chief crops are onions, potatoes, lily bulbs and flowers, parsley, carrots, beets, radishes, arrowroot, beans, tomatoes and peas.

Animal life is scarce, excepting introduced and more or less domesticated species. The native birds are the Ground Dove (*Chaemepelia passerina bermudiana*), Redbird (*Cardinalis cardinalis cardinalis*), Bluebird (*Sialia sialis sialis*), Catbird (*Dumetella caroliniensis*) and Bermuda Vireo, or Chick-of-the-village (*Vireo griseus bermudianus*). The crow, partridge and English sparrow are also common. The white-eyed vireo is also seen.

The indigenous plants are the cedar (*Juniperus Bermudiensis*), palmetto (*Sabal umbraculifera*), mulberry (*Morus rubra*), seashore grape (*Cocoloba uvifera*), mangrave (*Rhizophora mangle*), argemone (*A. mexicana*), creeping sorrel (*Oxalis virginica*), bay bean (*Dolichos roseus*), butterwood (*Conocarpus procumbens*), Burrbush (*Triumfetta althaeoides*), passion flower (*Passiflora minima* and *P. coerulea*), fennel (*Foeniculum vulgare*), prickly pear (*Opuntia vulgaris*), vervain (*Stachytarpheta jamaicensis*), sage bush (*Lantana crocea* and *L. odorata*), bindweed (*Polygonum convolvulus*), spurge (*Euphorbia buxifolia*), pigeon-berry (*Duranta plumieri*), Spanish bayonet (*Yucca aloifolia*), aloe (*Aloe soccotrina*).

There are 27 ferns, including a very pretty Maiden-hair.

A list of plants which had escaped from gardens, noticed during the visit was presented as well as one of introduced weeds. Numerous specimens and views were shown by the speaker as well as some fruit, but unfortunately this latter had not kept well. Several questions were asked by members present, and altogether it was a most interesting meeting.

E. H. B.

Feb. 15th, at the home of Mr. Geo. H. Clark, the following members being present: Messrs. G. H. Clark, R. B. Whyte, H. T. Gussow, J. W. Eastham, J. R. Dymond, H. A. Honeyman, A. Eastham, E. D. Eddy, J. J. Carter, D. Freeman and J. W. Gibson. Two topics were presented, (1) "Elevator Screenings as a Means of Plant Dispersal," by Mr. J. R. Dymond, of the Seed Branch of the Department of Agriculture. (2) "Common Fungi in Wood," by Mr. J. W. Eastham, Chief Assistant Botanist of the Experimental Farm. Both topics were treated by the respective leaders in a thoroughly capable manner and were discussed by the members present.

Mr. Dymond, who has made a thorough investigation of the uses as well as the dangers connected with elevator screenings, having spent some time at the large elevators at Fort William, first dealt with the great menace to agriculture arising out of the rapid spread of noxious weeds in Canada. He gave some figures that cannot but challenge the attention of everybody interested in our leading industry—agriculture. He stated that no less than 10,000 tons of weed seeds were screened from western grain handled at the elevators at Fort William annually, and estimated that the cost of harvesting, threshing, freighting and screening weed seeds was in the neighbourhood of half a million dollars per year. These seeds, however, were not entirely worthless, and sometimes represented quite a considerable revenue to the elevator companies, who shipped them in car load lots to Chicago and other American cities, where they were used as fodder. From $10 to $12 a ton is paid for such elevator screenings at Fort William, so that the consumer has to pay from $15 to $18 a ton for them. Such screenings frequently contain seeds injurious to the health of animals, but it has been found that sheep are able to eat them without any apparent injury, and indeed thousands of sheep are fattened on such screenings every year. The feeding value of such screenings depends largely upon the character of the fodder grains found in them. For example a composite sample of wheat screenings was found to give the following analysis:—20 per cent. wheat and barley; 12 per cent. oats and wild oats; 30 per cent. buckwheat screenings; 12 per cent. lamb's quarters; 3 per cent. tumbling mustard; 2 per cent. other mustards; 2 per cent. other weed seeds; 19 per cent. chaff, etc.

It was explained how, that on account of this gigantic waste the present system of grain inspection has been evolved. All grain, practically, coming to Fort William, is docked. The average dockage in wheat is 2½ per cent., and on flax is 5 per cent. to 7 per cent. As a rule the elevator companies get whatever revenue comes from the sale of all screenings. The total dockage for 1911-12 was as follows:- wheat, 23,000 tons; flax, 14,000 tons; oats, 1,500 tons; barley, 750 tons.

In conclusion Mr. Dymond pointed out the importance of doing two things: (1) To provide some means whereby grain screenings could be devitalized on a commercial basis, and (2) to take out such seeds as are injurious to stock, and to dispose of the saleable part to Canadian stock men rather than to Americans.

In discussing fungi, Mr. Eastham first reviewed some general characteristics of the class, such as absence of chlorophyll, parasitism and saprophytism. He referred to the injurious nature of parasitic fungi in causing many diseases in plants and to the equally beneficial nature of saprophytic fungi in reducing fallen leaves, trees and other organic debris to simpler materials which at once become the food of growing plants again. He stated that there was no hard and fast line separating saprophytic from parasitic fungi, as for example, when a certain species of parasitic fungus had worked the destruction of a living tree it might still continue to exist upon the wood of the dead tree (saprophytic). He pointed out that the part that one sees above the substratum on which it grows is but the fruiting body, whereas the part which actually destroys the wood, viz., the mycelium, is buried out of sight and is found penetrating the fibres of the wood sometimes for several feet from the point where the external fruiting body is located. He traced the evolution in the structure of the fruiting body from the simplest of freely exposed plate-like discs to the more complex gill-bearing and tube-forming species. In this connection it was also noted that each species had its own peculiar adaptation for the successful distribution of its spores. In one case, viz., that of the common polypore which grows on the sides of trees, it was admirably shown by an excellent specimen that the vertical position of the spore-bearing tubes is essential to distribution of spores and that when the position of the fruiting body had been altered by the falling of the tree that a re-adjustment of the plane of the fruiting body through 90° had taken place the succeeding season. Another specimen exhibited showed the effects of the mycelium in changing the colour of the wood fibres from the normal shade to a brilliant green.

During the discussion which followed Mr. Eastham's address Mr. Gussow referred to several peculiar uses of the tissue produced by the fruiting bodies of certain fungi that grow on wood. He cited an instance which had come under his own observation where the silk-like fibres from the under or spore-breeding surface of a polypore had been used in the making of a remarkably good cap. He also referred to the peculiar way in which rude fire-arms were discharged at the time of the Thirty Years' War in Europe. Some of the dry and spongy fibres collected from the fruiting bodies of certain wood fungi were used somewhat after the manner of a fuse. This was ignited by sparks from a steel and flint and "eventually" the gun went off.

J. W. G.

NOTES ON THE OCCURRENCE OF INTERESTING FORMS OF CYPERACEÆ IN QUEBEC.

By Bro. Victorin, Longueuil College, Longueuil, Que.

Very little is known of the distribution of our local Cyperaceæ. Being of slight or no economic value, these plants are of no interest to the average man, and even botanists themselves frequently overlook them.

Apart from any utilitarian consideration, the sedges play an important part in nature. It is by means of this type of organism that plant life takes hold of marshes, shoals, river-banks and damp places generally. If the finality of the multitude of individuals appears obvious, that of the immense number of species is yet an unsolved problem. It is to be remembered that the study of the *Carex* species alone, numbering about 1,000, constitutes a whole science by itself, and demands the labour of numerous specialists.

The object of these notes is to make known several species, or varities, of this family, collected by the writer, in Quebec, which are, he believes, mostly new for that province, if not for Canada.

1.—*Cyperus Schweinitzii* Torr.: Collected at Oka, P.Q., on the alluvial barrens bordering the Lake of Two-Mountains. It was hitherto known in Canada only from the Great Lakes region, southern Ontario and the Northwest. The limits of this *Cyperus* are, therefore, considerably extended; it will probably prove to be fairly abundant in the Lower Ottawa Valley, when properly separated from common *C. esculentus* L. In the field, *C. Shweinitzii* can be readily distinguished from *C. esculentus* L. by its much more slender culm.

2.—*Scirpus Torreyi* Olney: Collected at St.-Eustache, P.Q., in the Ottawa River, near the outlet of the Lake of Two-Mountains. This large Bulrush belongs to the group of common *Scirpus Americanus* Pers. Up to the present time, the northern limit of *Scirpus Torreyi* was not supposed to intersect the boundary line between Canada and United States. The present discovery would lead us to conclude that it occurs throughout the waterways of western Quebec. *Scirpus Torreyi* fruits later than any other tall Bulrush in the east. In early August, the St-Eustache specimens were yet poorly developed though sufficiently mature to permit certain identification.

3.—*Scirpus pedicellatus* Fernald: St-Bruno, P.Q. In clearings, on peat, August, 1912. Recently separated by Prof. Fernald, of the Gray Herbarium.,

4.—*Scirpus atrocinctus* Fernald: Alluvial banks, Lake Nominingue, P.Q., August, 1912. Also recently separated. Will prove abundant in Quebec. Many herbarium specimens labelled *S. cyperinus* are likely this species.

5.—*Scirpus atrocinctus* Fernald, var. *brachypodus* Fernald. Châteauguay, P.Q., July, 1912. Spikelets in dense, irregular clusters, the boreal form of the species.

6.—*Scirpus cyperinus* (L) Kunth, var. *pelius* Fernald. Alluvial banks, Lake Nominingue, P.Q., August, 1912. Growing intermingled with *S. atrocinctus*. The very long involucral bracts characterize the species as does the deep colour of the involucels for the variety. The plant begins to fruit when *S. atrocinctus* is already mature.

7.—*Scirpus subterminalis* Torr.: Aquatic, nearly submerged species. First collected in 1908, in Megantic Co. (Nat. Can. XXXVI, No. 5; mai, 1909). Found again in a small lake near St-Jerome, Terrebonne Co. This interesting species must range throughout Quebec.

That further investigation will add much to our knowledge of the Cyperaceæ in Quebec, is beyond doubt. More material, however, and a close study of collections already made, are necessary before a complete treatment of the subject can be undertaken.

BOOK NOTICE.

CANADIAN ALPINE JOURNAL; Special Number; pp. 96, with map and many plates. This special number of the Canadian Alpine Journal is made up of reports on the mammals, birds and plants collected and noted by the naturalists who accompanied the Alpine Club expedition to Jasper Park, Mount Robson, and the Yellowhead Pass, in July and August, 1911, and forms a supplement to the detailed, fully illustrated report of the Topographical Section of the Alpine Club published in Vol. IV of the Canadian Alpine Club Journal. Copies of both the Journal and the special number here reviewed may be had from the Secretary-Treasurer of the Alpine Club, Sidney, B.C., the price of the latter being $1.00.

About half of the special number is made up of Mr. N. Hollister's report on the "Mammals of the Alpine Club Expedition to the Mount Robson region," which is prefaced by a short itinerary and the delimitation of the life-zones represented in the region covered by the expedition. Six new mammals are described, two bats (*Myotis pernox* and *Myotis altifrons*), a marmot (*Marmota sibila*), a chipmunk (*Eutamias ludibundus*), a spermophile (*Callospcrophilus lateralis tescorum*) and a caribou (*Rangifer fortidens*). Very full descriptive and other notes make this list of mammals the most valuable one that has been published on the Canadian Rocky Mountain region. It is followed by a short list of the Reptiles and Batrachians.

In his paper on the birds collected or observed on the expedition, Mr. J. H. Riley enumerates seventy-eight species, and while no new forms are described not the least valuable part of Mr. Riley's contribution is his notes on the habits of some of the more important birds, and the plumage and other variations noted. Altogether his list will be of great value to visitors to Jasper Park and will serve as a basis for future work in that region. As no species are enumerated which were not collected or noted by the Alpine Club party the list is not complete, but is all the more valuable on that account, as no doubtful species are included.

Messrs. Hollister and Riley made in connection with their work a small collection of plants, 147 in all. These plants have been determined, and four species described, by Mr. Paul C. Standley. It is unfortunate that Mr. Standley should have prefaced his paper by saying that: "It was to be expected that plants from this particular area, where previously no botanical collections had been made, would contain many things of interest." As a matter of fact many of Drummond's types were collected in or near this very area, and, in 1898, Mr. William Spreadborough, of the Geological Survey staff, spent the whole collecting season in the Jasper Park region. No complete list of Mr. Spreadborough's plants was published, but many new species were described in *Pittonia*,* by Dr. Greene, and notes on interesting species by the writer in THE OTTAWA NATURALIST.† Drummond's plants are all labelled "Rocky Mts. between Lat. 52° and Lat. 56°," but it is known that he went west from Edmonton to the Rocky Mountains and worked north. All four of the species described by Mr. Standley (*Carex atrosquama*, *Vagnera pumila*, *Gaillardia bracteosa* and *Artemisia lævigata*) were collected by Spreadborough and are in the herbarium of the Geological Survey. None of them were thought worthy of specific rank or even of separation from well known species, although *Carex atrosquama*, now described by MacKenzie, may stand as a segregate from the *C. atrata* group. Of *Vagnera pumila* it may be said that none of the characters given by Mr. Standley as separating it from *V. trifolia* are peculiar to the Jasper Park plant, many of our northern Canadian specimens exhibiting all of them; the best that can be said of this proposed species is that if separable from *V. trifolia* of the United States it extends from Newfoundland to the Northern Rockies; among Spreadborough's specimens we find the long-exserted raceme and those barely longer than the leaves among plants of the one collecting. An attempt was made by Prof. John Macoun in 1884‡ to separate the forms of *G. aristata*, but they so intergraded that it was found to be impossible. An examination of some thirty sheets from western Canada shows a wide range of variations and Spreadborough's specimens from Maligne River and from near Henry House give *between them* all the characters used by Mr. Standley to separate *G. bracteosa* from *G. aristata*. Without comparison with a large series of Canadian specimens *G. bracteora* might stand as a species, but after comparison it must be considered to be only one of the many intergrading forms of *G. aristata*. *Artemisia lævigata* may be all right, but it also belongs to a very variable group from which many segregates have been described. It was first collected by Drummond in the Rocky Mountains in Lat. 52°. Drummond's plant was referred to *A. Norvegica* by Hooker and to *A. arctica* by Torrey and Gray. Spreadborough collected it in the Yellowhead Pass. The list of plants, notwithstanding the above criticisms, is a most useful one and the only one available for the Jasper Park region.

This special number of the Alpine Club Journal brings together just the kind of information that will be wanted by visitors to Jasper Park and should be in the hands of everyone who goes there.
J. M. M.

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*Pittonia Vols. IV and V.

†Ottawa Naturalist, Vol. XII, p. 161 et seq.; Vol. XIII, p. 166 et seq.; Vol. XV, p. 269 et seq.; Vol. XVI, p. 217 et seq.

‡Cat. Can. Plants, Vol. I, p. 250.

PRELIMINARY LIST OF OTTAWA SPHÆRIIDÆ.

In the NATURALIST for March, 1890, the late Revd. Geo. W. Taylor and the writer published a catalogue of the recent Mollusca of Ottawa, as recorded in the publications of the Club up to that time. The list included five *Sphæria—sulcatum*, *striatinum*, *stamineum*, *rhomboideum* and *occidentale*; four *Musculia—partumeium*, *securis*, *rosaceum* and *truncatum*; and five *Pisidia—virginicum* (as adamsi), *compressum*, *abditum ventricosum*, and *rotundatum*. Three of the *Pisidia* are listed with a (?), indicating doubtful identification.

In many of the years that have since elapsed, but little work was done. Not much leisure until recently fell to the lot of any of the remaining few who were disposed to interest themselves in things so uncommercial as our inland shells. During the past three summers, however, opportunities afforded for the first time were taken advantage of. The hunting grounds of other days and manners were revisited, and new ones sought farther afield. A very large quantity of material was collected—some species in thousands—and submitted to Dr. V. Sterki of the Carnegie Museum, who is recognized the world over as the supreme authority in the *Sphæriidæ*. The list which follows has in every case the sanction of his identification. I am under the deepest obligation to him. I also desire to acknowledge my indebtedness to Mr. C. W. Johnson, of the Boston Museum of Natural History, for his kindness in comparing specimens from Ottawa with Prime's types, or with shells bearing Prime's labels. Dr. Sterki has in addition generously presented me with co-types of many of the species which he has described.

While the list which follows is intended to be merely preliminary, it is believed to be correct as far as it goes. No species has been included from localities not in the Ottawa Valley, and with few exceptions the shells have been found within or near the limits of the Capital City.

SPHÆRIUM.

1. S. sulcatum, Lamck.
2. S. striatinum, Lamck.
3. S. stamineum, Con.
4. S. rhomboideum, Say.
5. S. occidentale, Prime.
6. S. aureum, Prime.
7. S. crassum, Sterki.
8. S. emarginatum, Prime.
9. S. flavum, Prime.
10. S. torsum, Sterki.

MUSCULIUM.

11. M. partumeium, Say.
12. M. securis, Prime.
13. M. rosaceum, Prime.
14. M. truncatum, Linsley.
15. M. transversum, Say.
16. M. parvum, Sterki.
17. M. ryckholti, Norm.
18. M. winkleyi, Sterki.
19. M. declive, Sterki.

PISIDIUM.

20. P. virginicum, Gm.
21. P. compressum, Prime.
22. P. abditum, Hald.
23. P. ventricosum, Prime.
24. P. rotundatum, Prime.
25. P. aequilaterale, Prime.
26. P. affine, Sterki.
27. P. glabellum, Sterki.
28. P. milium, Held.
29. P. minus, Adams.
30. P. noveborascense, Sterki.
31. P. ohioense, Sterki.
32. P. pauperculum, Sterki.
33. P. politum, Sterki.
34. P. rotundatum, Prime.
35. P. sargenti, Sterki.
36. P. splendidulum, Sterki.
37. P. streatori, Sterki.
38. P. strengi, Sterki.
39. P. subrotundum, Sterki.
40. P. succineum, Sterki.
41. P. variabile, Prime.
42. P. walkeri, Sterki.

There is a quantity of material still under consideration and much more will, it is hoped, be secured during next summer. Several additions will, I think, be made to the list of Sphæria and Musculia, and many to the already lengthy catalogue of our Pisidia. These minute shells occur everywhere throughout the district in such great numbers and variety that their determination is a matter of extreme difficulty. When Dr. Sterki has further studied the specimens now before him and the collections of 1913, a fairly complete list might be published, with the localities in which they are found, and figures of the larger or more beautiful species. L.

THE OTTAWA NATURALIST

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THE MANUS IN A SPECIMEN OF TRACHODON FROM THE EDMONTON FORMATION OF ALBERTA.*

By Lawrence M. Lambe, F.G.S., F.R.S.C.; Vertebrate Palæontologist, Geological Survey, Ottawa, Canada.

The present paper has particular reference to the osteology of the front feet, or hands, of a specimen of Trachodon discovered last summer in the Edmonton formation (upper Cretaceous) of Red Deer river, Alberta, by the Geological Survey vertebrate palæontological field party under Charles H. Sternberg. This specimen is now being mounted in high relief preparatory to being placed on exhibition in the museum of the Geological Survey, Ottawa.

The skeleton of this Trachodon is almost complete from the front margin of the snout to the sixth caudal vertebra, but the remainder of the tail is missing. This defect, however, can be remedied to a great extent in mounting the specimen as fortunately a large portion of the tail of another individual of similar size was found at the same locality and can be used to take the place of the missing vertebræ.

This skeleton was found on its right side with the head bent downward, the front legs stretched out, and the long hind legs drawn up. Although it has been subjected to considerable pressure, the effect of which is apparent, there has been remarkably little displacement of any of the bones. The specimen is being mounted in the exact position in which it was discovered. The rock is a sandy clay, mostly soft and easily cut away, but a tenacious layer of clay iron-stone coats some parts of the skeleton and is removed with difficulty. The bones have undergone a varying amount of silicification and are in parts considerably fractured.

A clear and sharp impression of the tuberculated skin is preserved to the left of the mid-line of the back, above the sacrum, for a distance of about four feet. Large polygonal tubercles, averaging about ¼ of an inch in diameter, are here seen to form oval shaped clusters, from 2 to 3 inches in maximum diameter, surrounded by small tubercles, about $\frac{1}{10}$ of an inch in average diameter, occupying the intervening spaces, which are about ¾ of an inch across.

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* Communicated with the permission of the Director of the Geological Survey.

Of particular interest is the lattice-like arrangement of the ossified tendons in three tiers, or layers, on each side of the neural spines of the back. These rod shaped tendons have been known to occur in Trachodon, but in no specimen, so far as the writer is aware, has their exact disposition been revealed and described. In the Red Deer river specimen of last summer's collection some of the tendons are seen to fork, or bifurcate, and their arrangement in a triple series is shewn in a very clear and perfect manner. A somewhat similar disposition of ossified tendons, in a double series, in the back and tail has been suggested in published descriptions of Iguanodon and Camptosaurus.

The Red Deer river specimen is in an excellent state of preservation as a whole, and is one of the most complete of the skeletons of Trachodon mounted in the museums of this continent. As it is unusual to find the front feet with most of the bones represented, and but little disturbed, a short description of them is here given. It is proposed to publish, at a later date, particulars regarding the shape and position in this skeleton of the ossified tendons, and of such other structural characters of interest as further study of the osteology of the individual may bring to light.

Of the four digits in the manus all the phalanges are represented with the exception of the terminal one of digit II. As digits III, IV and V ended distally in a hoof (or nail) carrying bone it is probable that digit II, the inner finger, bore a terminal hoof-phalanx also.

The phalangeal formula presented by this specimen is as follows:—

Digit II. .Three phalanges, the terminal one presumably a hoof-bone.
Digit III. .Three phalanges, the terminal one a hoof-bone.
Digit IV. .Two " " " " "
Digit V. . " " " " " "

This formula differs materially from the one given by Mr. Barnum Brown in a paper entitled "The Osteology of the Manus in the Family Trachodontidae*" and descriptive of the fore foot of a specimen of *Trachodon annectens* (Marsh) in the American Museum of Natural History, Cat. No. 5060, from the Lance formation of Converse County, Wyoming, U.S.A., a specimen remarkable for the completeness of the skin impression which has been made the subject of a recent memoir by Professor Henry Fairfield Osborn.**

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* Bull. Am. Mus. Nat. Hist., vol. xxxi, art. x, pp. 105-107, fig. 1. New York, U.S.A., May 28th, 1912.

The phalangeal formula of the fore foot of this specimen of *Trachodon annectens* is given by Mr. Brown as being—

Digit II......with three phalanges, the third a hoof.
Digit III...... " " " " " "
Digit IV...... " " " no hoof.
Digit V...... " " " " "

It is thus evident that this formula, as interpreted by Mr. Brown, is not applicable to the family Trachodontidæ as a whole.

In the Red Deer river Trachodon from the Edmonton beds the fore feet were in the position indicated in plates I and III. In removing the rock particular care has been taken to keep each bone in the exact position in which it was found, so that any observer of the mounted skeleton, or any reader of this paper, with the aid of the illustrations provided, would be in a position to interpret for himself the phalangeal formula presented. This policy of nondisturbance of the bones has been carried out in the preparation and mounting of the entire skeleton.

In both hands the metacarpals II, III and IV are grouped together in close contact, whilst the fifth metacarpal lies somewhat apart.

In the right manus the dorsal surface of digit II, and the palmar surface of the other three digits are presented to view. Owing to the pressure to which the specimen has been subjected digits IV and V have been brought to the same level as digit III. Digit II is at a higher level, directly over and pressed down on digit III.

In the left manus the palmar surface of digits II and III, and the dorsal surface of digits IV and V are uppermost. Digits II and III lie in the same horizontal plane whilst digits IV and V are at a higher level, digit IV resting on digit III.

The right ulna and radius are seen from behind, and the left ulna and radius obliquely from without and behind.

The ulna and radius in each arm, and some of the metacarpals and phalanges, shew the effect of vertical compression, to a varying extent, in an exaggerated breadth. This distortion is given in the accompanying figures, but is probably most clearly expressed in plate III, reproduced from a photograph.

** Memoirs Am. Mus. Nat. Hist., new series, vol. I, part II, Integument of the Iguanodont Dinosaur Trachodon, pp. 33-54, plates V-X, with seventeen text figures. New York, 1912.

Regarding the fore feet as webbed and adapted for swimming, the digits were most probably capable of being spread laterally to some extent, probably more than is indicated in the figure forming plate II, which is intended to represent the hand in a moderately quiescent state.

As shewn in plates I and III, the metacarpals II, III and IV of both hands are parallel to each other and pressed together, with metacarpals II and IV brought round metacarpal III toward each other; the result probably of the contraction of the skin after the death of the animal and not indicative of the proper position of these bones when the creature was alive. Mr. Brown, in figure 1 of his paper, already cited, representing the "Manus of Trachodon correctly assembled" places metacarpals II, III and IV in this position of close contact which is not, in the writer's opinion, the true position of these bones in a fore foot capable of being used with much effect in swimming.

In the Red Deer river specimen the different bones of the digits are distinctive in shape and can be recognized in each hand. Metacarpals III and IV are of about equal length. Metacarpal II is considerably shorter, and metacarpal V is less than half as long as Nos. III and IV. The distal end of metacarpal III is enlarged, but in the other metacarpals the proximal end is the larger, the difference in size between the two ends being not so great in metacarpal II. The articulating surfaces of these bones are evenly rounded.

Plates I and III shew accurately the relative position of the bones of the hands to each other as found.

Digit V has two phalanges, of which the terminal one is smaller than that of digits III and IV. It has a more rounded outline, but, as in the others, is thick proximally and thin toward the distal margin. This terminal bone is well preserved in the right hand, is in position, and is in all respects a typically shaped hoof-bone. In the left hand a fragment regarded as the proximal end of the corresponding bone of digit V is shewn slightly in advance of the first phalanx.

The hoof-bone of digit IV of the right hand was found slightly out of place, as indicated in plates I and III. The corresponding bone in the left hand was missing and has been restored in plaster.

The three phalanges of digit III of the left hand are preserved and were found practically in place as shewn. The second phalanx of digit III of the right hand was missing and has been restored from the left hand, the restoration being placed in the sacpe found between the first and third phalanges.

The only bone not represented in either of the hands is the terminal phalanx of digit II, which is shewn in dotted outline in plate II, as a true hoof-bone on the assumption that, as the other three digits bore flattened hoof-bones, it is probable that the moderately long digit II had a terminal phalanx of this nature also. Two fragments found lying near and in front of the second phalanx of digit II of the left hand may be part of the missing hoof-bone in this hand, but it was not found possible to identify them as such.

The second phalanx of digit II is a distinctly triangular bone and is preserved in both hands, where it occurs with its pointed side directed inward. A similarly shaped bone is described and figured by Mr. Brown as occurring in the manus of *Trachodon annectens* as the second phalanx of digit IV with its narrow side pointing outward.

A carpal bone is preserved in each hand, in the same position, viz., at the ulnar side of the end of the radius. In addition, a smaller carpal bone was found in the right hand, at the middle of the end of the ulna, but a corresponding second carpal was not found in the left hand.

The teeth of the Trachodon from the Edmonton formation, whose fore feet are described above, agree in size, shape and marginal sculpture with those of *Trachodon marginatus*, Lambe*, from the lower horizon of the Belly River formation, whose beds are exposed a few miles farther down Red Deer river to the south-east. As the marginal sculpture of the teeth is one of the principal specific characters of *T. marginatus* the specimen from the Edmonton formation is regarded as belonging to the species from the Belly River formation until evidence is obtained to prove that a specific difference exists between them.

EXPLANATION OF PLATES.

PLATE I—The fore feet of the specimen of Trachodon from the Edmonton formation of Red Deer river, Alberta, Cat. No. 8399, shewing the bones in the position in which they were found. One-sixth the natural size.

PLATE II—The right fore foot of the same specimen, dorsal aspect, with the bones in, what is considered to be, their natural position. One-sixth the natural size.

PLATE III—Reproduction from a photograph of the fore feet, of the same specimen, as mounted. One-sixth the natural size.

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* Contributions to Canadian Palæontology, vol. III (quarto), part II, 1902. New genera and species from the Belly River series.

A FURTHER NOTE ON CRYPTOLITHUS VERSUS TRINUCLEUS.

By PERCY E. RAYMOND.

Judging from the protests which I have received since the publication of my note on "Some Changes in the Names of the Genera of Trilobites" in the February number of the NATURALIST, there is a deep and universal feeling against giving up the familiar name *Trinucleus*. It is readily admitted by all that the name *Trinucleus* has no standing, but it has existed so long and has become so familiar, that the general opinion seems to be that it would be unwise to give it up now. It is interesting to note how this same feeling has come down through the literature. It will be remembered that *Cryptolithus* was described in 1832 by Green[1], who gave a recognizable description and figure. In describing *Trinucleus* in 1839, Murchison[2] cites *Cryptolithus* as a synonym of the *Trinucleus*, Lhwyd, 1698, but after his generic description he adds: "Seeing that these distinctions, as above defined, prevail in several species of Trilobites, I have formed them into a *new* genus under an old name assigned to one species of an animal of this kind of Lhwyd."

In this same year, Emmrich[3] referred four of Murchison's species to *Cryptolithus*, and Goldfuss in 1843 also used *Cryptolithus*, as did Emmrich again in 1845. In these same years, however, (1840-1845), Milne-Edwards, Eichwald, Burmeister, Munster, Portlock, and Lovén all used *Trinucleus*, either under the influence of the prestige of Murchison, or for the reason which influenced Hall[4] in 1847 in "adopting the generic name of Lhwyd as given by Murchison." Hall evidently believed in priority, but the third edition of Linnæus had not then been fixed upon as the point beyond which one should not go in reviving old names.

Barrande, in 1852, gave a good resumé of the uses of the names, and while he decided for *Trinucleus* on account of priority, he says: "Quelques savans, au nombre desquels nous distinguons Bronn et Goldfuss, ont maintenu le nom de *Cryptolithus* qui, sous certains reports, a le droit de priorité. La plupart des paléontologues ont employé de préférence la dénomination plus ancienne de *Trinucleus*, bien qu'elle date d'une époque où la nomenclature systématique n'était pas encore introduite dans la science. Il y a là une question de droit, qui nons semble compliquée. Il nous appartient pas de la résoudre, et dans le doute, nous avons adopté le nom généralement admis dans tous les pays, et que nous voyons introduit jusqu'en Amérique, par J. Hall, dans son bel ouvrage sur la Paléontologie de New-York."[5]

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[1] Monthly American Journal of Geology, vol. 1, No. 12, p. 560, 1832.
[2] Silurian System, p. 659, pl. 23, 1839.
[3] De Trilobitis, etc., p. 49, 1839.
[4] Paleontology New York, vol. 1, p. 249, 1847.

The next year, Salter[6], in speaking of the name *Trinucleus* says: "The name of the genus can only be retained by general consent, for the typical species was formerly denominated *Cryptolithus*, and sufficiently described by Green;" . . . . . . "But in this case strict priority may be allowed to yield to classical feeling." In 1854, Angelin[7] used the family name *Cryptolithidæ* though he employed *Trinucleus* for the genus.

From 1854 to 1890 *Cryptolithus* seems to have been pretty effectually submerged, but attention was drawn to it in the latter year by Vogdes[8], who says of *Cryptolithus*: "This generic name should replace that of *Trinucleus*"; and again: "Sir. R. I. Murchison has revived this old name of Lhwyd's, and all subsequent paleontologists have adopted it. Lhwyd's description meant no more than the general name trilobite of the more modern writers, and could not, except by courtesy, set aside Dr. Jacob Green's genus *Cryptolithus*."

Thus we may divide the users of these names into three classes: first, those writers who from 1832 to 1851 used *Cryptolithus*; second, those who, like Hall, Barrande, and their followers, turned to *Trinucleus* on the ground of supposed priority; and third, men like Murchison, Salter, and many modern writers, who knew that *Cryptolithus* had priority, but who preferred the better name. On the mere ground of sentiment, which of course should have no weight at all, there would seem to be as much in favor of *Cryptolithus* as *Trinucleus*, and as a matter of simple justice everything points to the former name. The only argument against returning to *Cryptolithus* is the one of present convenience, and I must admit that is, practically, a very weighty argument. *Trinucleus* has gotten such a firm hold upon us that it will take more than ordinary courage to give it up. And it should be pointed out that we are in a fair way to saddle ourselves with more cases of this same kind. It will be interesting to see whether present day paleontologists are going to allow such names as some of those recently proposed by Jaekel for Agnostid genera or the still more flagrant *Glockeria* of

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[5] Systeme silurien du centre de la Boheme, vol. 1, p. 610, 1852.

[6] Memoirs Geol. Sur. Unit. Kingdom, Dec. 7, p. 5, 1853.

[7] Palaeontologia Scandinavica. Pars 1. Fasc. 2, p. 64 of 3d ed., 1878.

[8] Bull. U.S. Geol. Survey, No. 63, pp. 107, 148.

Wedekind[9] to get the same standing that *Trinucleus* has.

Enough of the destructional phase of the subject. When I wrote before I did not see any way in which the name *Trinucleus* could be retained, but after studying the large collection in the Museum of Comparative Zoology, a way has presented itself. The present tendency is to split our large genera up into a number of smaller groups, and "*Trinucleus*" must doubtless be so divided. There are at present only two divisions in use, *Cryptolithus* or *Trinucleus*, and *Tretaspis*, McCoy. As stated in my previous paper, Murchison's first species, *Trinucleus caractaci*, is strictly congeneric with *Cryptolithus tessellatus*, but fortunately Murchison described six species when first proposing *Trinucleus*. The fifth of these species, *Trinucleus nudus*, is well known to be an *Ampyx*, and the sixth, *Trinucleus? asaphoides*, was referred by Salter to *Ogygiocaris buchii*. This leaves four species, the first and fourth of which, *Trinucleus caractaci* and *T. lloydi*, belong to the earlier genus *Cryptolithus*. The second and third, *Trinucleus fimbriatus* and *T. radiatus*,have been referred by Salter[10] to *Tretaspis*. Now the type of *Tretaspis* is *Trinucleus seticornis*, (Hisinger), as that species was understood by McCoy[11]. *Tretaspis* differs from *Cryptolithus* in having only the anterior part of the glabella bullous, while the posterior part is constricted and shows two pairs of deep glabellar furrows. The cheeks also show eye-lines and simple eyes are present, even in the adult. Young specimens of some species of *Cryptolithus* show a poor development of these same characters, but as they are retained in the adult of *Tretaspis seticornis*, *T. bucklandi*, and other forms, (*Tretaspis reticulatus*, Ruedemann is a good American example), the genus is a valuable one, and well founded. *Trinucleus fimbriatus* and *T. radiatus* do not, however, conform strictly to the type of either *Cryptolithus* or *Tretaspis*.

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[9] Since my previous paper was written, this recent blunder, for such it seems, has come to my attention. Wedekind, in an article on the "Klassifikation der Phacopiden" in the Zeitschrift der Deutschen Geol. Gessellschaft, Bd. 63, heft 3, p. 323, 1912, has proposed the generic name *Glockeria* with *Phacops glockeri* as the type. Reed, as recently as 1905, on page 226 of the Geological Magazine of that year, proposed the name *Phacopidella* with *Phacops glockeri* as the type. Wedekind refers frequently to Reed's paper, and quotes *Phacopidella*, though he nowhere says that that name is preoccupied or otherwise unusable. Wedekind's *Glockeria* is not the same as Reed's *Phacopidella*, but it seems obvious that we can not found two genera upon a single species. I regret to have to add that the name *Reedia* was used by Ashmead in 1904 for a genus of wasps (Canadian Entomologist, 36, p. 9), so that Wedekind's intended compliment to Professor Reed is lost. In passing, it might be noted that *Phacops fecundus* Barrande, is not the type of *Phacops* s. s. as Wedekind has made it.

[10] Mem. Geol. Sur. Unit. Kingdom, Dec. 7, p. 8, 1853.

[11] Ann. Mag. Nat. Hist., ser. 2, vol. 4, pp. 401, 410, 1849.

Speaking principally of *T. fimbriatus*, which is the better known species, it has glabellar furrows, though not so well developed as in the typical *Tretaspis*, but, so far as I can learn, lacks the simple eyes and eye-lines of that genus. But the greatest obvious peculiarity of the species is the character of the fringe, which, instead of being marked by concentric rows of perforations, is crossed by a system of radiating ridges and furrows. Reed has recently studied the fringes of the various English species of "*Trinucleus*", and he speaks thus of the fringe in *Trinucleus fimbriatus*:[12] "The upper surface has all the pits arranged in radial sulci except near the genal angles." And again; "the dividing radial ridges vary from the extreme development in *T. fimbriatus*, Murchison, to the scarcely differentiated structures in *T. nicholsoni*." I am aware that Reed also says of the arrangement of the pits in concentric or radial rows that "Frequently different stages occur in the same species or different parts of the fringe of the same individual," and that he does not seem to give very high classificatory value to the pattern of the fringe. Still, we have here an extreme development along one line, which, taken with the other characteristics of the specimens, form a combination which may have the value of a generic group. The principal characters seem to be as follows: Glabella obovate, glabellar furrows present, but weaker than in *Tretaspis*, eye-lines and simple eyes absent in the adult, fringe ornamented with radiating furrows separated by strong ridges. I would therefore propose to select Murchison's second species, *Trinucleus fimbriatus*, as the type of *Trinucleus*, and let the genus stand or fall on the basis of that species. Ruedemann's *Tretaspis diademata*[13] would certainly belong to the genus as thus restricted, and probably *Trinucleus coscinorhinus*, Angelin[14], as well. Professor F. R. Cowper Reed has announced his intention of revising the British species of *Trinucleus*, and it will be interesting to see if, when the species are better known, such a grouping will be of value. We seem to have four possible courses open to us, and of them I personally prefer the fourth:

First, use *Cryptolithus* and make *Trinucleus* a direct synonym.

Second, ignore *Cryptolithus* and continue to use *Trinucleus* on the score of convenience.

Third, make *Trinucleus fimbriatus* the type of the genus and make a broad enough definition to include the type of *Tretaspis*, in which case *Trinucleus* would replace *Tretaspis*, the latter genus going into the synonomy. This would be practically the position of Salter except that we would use *Cryptolithus* for *Trinucleus*, and *Trinucleus* for *Tretaspis*.

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[12] Geological Magazine, vol. 9, Dec. 5, pp. 349, 385 .1912,

[13] Bull. N. Y. State Museum, No. 49, p. 46, pl. 3, figs. 12-14,1901.

[14] Pal. Scandinavia, vol. 1, 3d ed., 1878, p. 65, pl. 34, fig. 4.

Fourth, use the three names, *Cryptolithus* for the type of *tessellatus* and *caractaci*, *Trinucleus* for *fimbriatus* and its allies, and *Tretaspis* for *seticornis* and the like.

ZAPUS PRINCIPS MINOR.

A NEW MOUSE RECORD FOR MANITOBA.

The mouse whose name appears above was one of a small collection recently determined through the courtesy of Dr. H. W. Henshaw, of Washington, who informs me that its capture at Aweme, Manitoba, constitutes, not only a record for the Province, but also extends the known range of this rodent considerably further eastward. As a matter of fact, however, these mice appear to be the usual race met with in south-western Manitoba, as we have yet to discover any other. They are found not infrequently on the edges of woods among low bushes and occasionally in tall grass in open situations.

Like other members of the genus, they are by no means easy to capture and their long jumps (from five to seven feet) combined with their habit of doubling, often completely mystify a dog, as they would doubtless a coyote or fox; besides this they have an instinctive knowledge of their colour resemblance to the surrounding objects and so, after a few puzzling leaps, will crouch down and remain perfectly motionless until danger seems past, when they creep silently away. This is when they have strayed from their burrows. When their homes are at hand they quickly vanish beneath the ground.

Zapus princips minor may be described briefly as follows: length 219 mm., tail vertabræ 131, hind foot 30; colour agaty, sides ochraceous, moderately covered with black tipped hairs; lower parts yellowish with a slight tinge of pink fading to white beneath. It resembles closely other species of the genus, particularly Z. *hudsonius campestris*, from which it differs, however, in being slightly smaller and more brightly coloured.

But one of these mice has previously been recorded for Manitoba, namely *Z. hudsonius*, the type locality for which is Hudson's Bay. Probably at least one other—*campestris*—will eventually turn up within our boundaries, and since the extension of the Province to Hudson's Bay, others may well be discovered in the north country. STUART CRIDDLE.

THE SHADE TREES OF OTTAWA.*

In this paper several introduced species are included, but only in a few cases are varieties referred to. Those who wish to learn about the most valuable varieties can readily do so at the Central Experimental Farm, where all hardy and useful varieties are being tested. We exclude from consideration in this paper all evergreens and fruit trees.

SALICACEAE.

There are about six species of native Willows that attain the character of trees, yet few of them can stand the dry soil of a city. They are more common in the country and along the borders of streams. As a family they have soft pliant wood, slender branches, and large fibrous roots. The roots are remarkable for their toughness and tenacity of life.

There are several large willows in a vacant lot near Rideau Gate, and throughout lower town they are more frequent than in the other parts of the city. I am not sufficiently familiar with the particular characteristics of this family in the winter to say to which species they belong—whether *Salix alba*, *S. nigra*, or *S. fragilis*, but think they belong to the first, the white willow. This willow possesses some of the more important qualities requisite for a shade tree: it can readily be transplanted and it has great tenacity of life. As long as it has sufficient moisture it will grow. And yet it is not a tree to be recommended. It cannot compare in beauty either of foliage or of outline with other trees. Yet there are some exceptions.

The Weeping Willow, *Salix Babylonica*, is an introduced species, and deserves mention as a remarkably graceful tree, although it is more commonly associated with cemeteries than as a city shade tree; and I do not know of one growing in the city, although it is included in the catalogue of trees and shrubs that grow at the Experimental Farm, and is classed as "hardy." There are about 150 species or varieties of willow planted there, of which one half are counted as hardy, and possibly more would have thrived if planted on the low ground near the Canal. The Wisconsin Weeping Willow, *S. Babylonica dolorosa*, has been introduced along the Driveway and is doing well.

Among the Poplars the most important is an introduced one, *Populus nigra pyramidalis*, the Lombardy Poplar. This tree possesses a very characteristic outline, even more so than the elm, and is therefore well known to everybody. This outline is just as marked in the winter as in the summer. Its branches are perpendicular and long, the terminal twigs having a slight inward curve. When blown by the wind the whole tree sways with a graceful feathery effect. Perhaps the best known of these poplars are the ones that can be seen from the Plaza in Major Hill Park. They overlook the canal, and from their position show to good effect, and form a picturesque sky-line. There are many other Lombardy Poplars throughout the city, and their number might well be increased, for this is a handsome tree, holding its leaves late into the autumn.

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*Paper read by Dr. E. H. Blackader at a meeting of the Botanical Branch held at the residence of Mr. J. J. Carter, March 1st, 1913.

The Balsam Poplar, *P. balsamifera*, is a native species, and holds its own in the city, although it appears to be rarely transplanted to the street line, but grows in gardens or in neglected lots. In some cities it is recommended where there is much coal smoke. It is a large, handsome tree, with several shades of yellow or greenish-yellow to brown on the large limbs.

The Cottonwood, *P. monilifera* or *deltoides*, grows to a large size and is fairly common. One great objection to this poplar is the enormous quantity of cottony stuff that falls for two or three weeks in the early part of the summer, and is carried everywhere by the wind.

The Abele, or Silver or White Poplar, *P. alba*, probably also grows about the city, and may be recommended where there is plenty of space. The peculiar white-tomentose matter on the under surface of the leaves is characteristic, and the peculiar mingling of green and white makes this tree a very effective ornamental one. This beautiful silveriness of the under surface is rather heightened in the twilight. One great disadvantage of this tree is the numerous suckers it produces.

JUGLANDACEÆ.

The Butternut, *Juglans cinerea*, grows commonly all around Ottawa, and there are probably some growing within the city limits. When in the open its huge branches spread out almost horizontally. Its terminal twigs are large, and its leaves are late in coming out and fall early. Nevertheless, the large compound pinnate leaves give a very handsome effect, and the tree is well worthy of cultivation where there is plenty of space.

The Walnut, *J. nigra*, deserves to be planted more commonly around the city. The branches are much more upright or ascending than the butternut. The bark is darker in color, and the leaves are quite smooth above. The only tree I know of in the city is situated well in from the street line at the south-west corner of O'Connor and Somerset Sts.

The Hickory, sub-family *Carya*, is mentioned more for the wish to see it than the fact that it exists here. *Carya alba* or *Hicoria ovata*, the shell-bark hickory, is the most important and the most characteristic of the family. Its wood is so valuable that possibly it has become exterminated in this locality. It ought to be replanted, especially in the large parks at Rockcliffe or Britannia, or if the Government provide for a National Park. It appears to be spreading on Mount Royal Park at Montreal. No doubt the fruit would be appreciated both by squirrels and boys. The bark of this tree is characteristic and peculiar. It breaks up into oblong plates, the ends of which curve outwards, while they cling at the centre. This peels off easily, hence the name, shell-bark or shag-bark.

BETULACEÆ.

(Including the Birches and the Hornbeams.)

Of the Birches the most ornamental and therefore the most valuable are the cut-leaved and pendulous or weeping varieties. How many varieties there are, I am not prepared to say, but they all seem related to *B. alba* or *B. populifolia*. Of course these beautiful varieties are of use only on lawns, but they are fairly common about the city. Their lower limbs come too low for them to be used along the street line, to say nothing of how much and how quickly they would be ruined by horses and passers-by.

The Common White Birch, *B. populifolia*, is common at Rockcliffe, and is too easily recognized to need description.

The Yellow Birch, *B. lutea*, also grows at Rockcliffe, but is much less common. It prefers rich, moist woodland. There are several trees in the hollow near where the new artesian well has been sunk. This is a beautiful tree in its native haunts. The bark of the trunk is of a yellowish or silver-grey color, which detaches horizontally in thin filmy layers which curl up like ribbons. In the spring the inner bark is a rich golden yellow. The catkins are upright, sessile, and very short in proportion to their breadth.

Of the Ironwoods the Hop Hornbeam, *Ostrya Virginiana*, is the only species, so far as I know, that is represented in the city. There is one on Gladstone Ave. near Metcalfe St., and several in Major Hill Park on the bank overlooking the pond. It is a tree that is more conspicuous and beautiful in the winter than in the summer, although the peculiar hop-like strobiles on the terminal twigs may attract the attention of some. But in the winter, and when standing all alone, then the tiny graceful birch-like twigs, tipped with bunches of two or three upright catkins, appear in all their native beauty. The trunk also is characteristic. It gives the appearance of strength. The bark is grey and split into numerous partly exfoliated strips, much narrower and tinier than on any other tree.

The other Hornbeam, *Carpinus carliniana*, may not grow within the city limits. A peculiarity of its growth is the manner in which the sinews of the branches are prolonged down the trunk, giving a peculiar muscular or Gothic effect. This is seen also to some extent in the beech. This tree is recommended for arbor-walks in the parks in some cities.

FAGACEÆ.

This includes the Beech, *Fagus ferruginea* or *grandifolia*, and the Oaks, *Quercus*, of which we have only two representatives. (The Chestnut, *Castanea dentata*, is rather a fruit tree, and does not thrive well here).

The Beech deserves to be planted much more commonly than it is. One great objection is that it is apt to be destroyed by boys with their penknives.

It is surprising, since our trees are leafless one half of the year, that so little attention is paid to planting for winter beauty. The winter beauty of the beech is considered quite equal to that of the elm. It is no less charming in early spring, and in the summer-time a forest of beeches has a most beautiful and bewitching effect. The compact, light grey bark of the beech tree is characteristic. This remains unbroken to a great age, and is perpetuated on the branches. Another noticeable feature is the muscular or buttress effect running down from the large branches, and more marked as the tree gets older.

There are several varieties of the Purple or Copper Beech, which add a beauty to a large lawn or park. Some fine specimens may be seen along the Driveway.

There are two species of oak that may be found in the city as shade trees, the Mossy-cup Oak and the Red Oak.

The Mossy-cup or Bur Oak, *Q. macrocarpa*, is very common in Ottawa South. The corky ridges on its branches gives it some resemblance to the Corky Elm. But the branches themselves are very different. In the elm the branches have all an outward and downward direction, in the oak they are contorted and angular, and never drooping.

The Common Red Oak, *Q. rubra*, is the prevailing type at Rockcliffe and in Rideau Hall grounds. This species belongs to the second group of oaks. Their leaves are bristle-pointed, and the fruit matures the second year. It most nearly approaches the English Oak, *R. robur*, in the effect it gives of massy strength and durability. These two species have the widest range, especially to the north, of any of the native species.

URTICACEÆ.

The American Elm, *Ulmus americana*, is deservedly the best known and the most popular of all our shade trees. Whether in the city or the country it is equally well known and equally useful and beautiful. It possesses many advantages. It can be readily transplanted, and stands a great amount of cutting and pruning. It thrives on almost any kind of soil. It is a fairly rapid grower, and soon spreads out in a broad umbrageous outline. Its lower limbs may be pruned away, leaving plenty of space for air and sunshine, and not losing in beauty of outline.

Besides the Common White Elm, there are several other interesting and valuable species in the city.

The Cork or Rock Elm, *U. racemosa*, is a valuable timber tree and is commonly planted. Perhaps it is too common, for the large corky ridges on its lower branches have a rather ungainly effect. The corky ridges on the lower branches are characteristic and probably more pronounced in the city than in its native soil.

The Slippery Elm, *U. fulva*, probably also grows in the city. It is a fortunate thing for its life that it is not so easily recognized. Its limbs are more rigid and divide at a slightly greater angle than the common elm. Its terminal branches and twigs do not have the outward and downward sweep that is so characteristic of the common White Elm. The simplest way of identifying this elm is to bite and moisten a twig with the saliva. The mucilaginous or slippery quality is then easily recognized by rubbing between the fingers.

The English Elm, *U. campestris*, and the Scotch Elm, *U. glabra*, are also planted about the city. There is one English Elm near the arcade on Parliament Hill. On Gloucester St. between Bank and O'Connor streets, there are several Scotch Elms, *U. glabra*.

The Hackberry, *Celtis occidentalis*, is mentioned more for the wish than the fact of its growing here. There was one tree growing along the banks of the Rideau River, in Ottawa South, but it perished last year in the march of city growth. There is no reason why this tree should not grow well along the Driveway. The hackberry has the outline of the elm, but it is out of its range here and rarely produces its fruit so far north.

Red Mulberry, *Morus rubra*, grows on Lisgar St., a few doors east from Bank St., on the south side. It is probably the only specimen in the city. The bark is scaly, and has a reddish tinge.

The terminal twigs are fine, and have an elm-like appearance. It seems to be a valuable and long-lived shade tree.

ROSACEÆ.

The only species that calls for our attention as a shade tree is the Mountain Ash. This is fairly common. Its bright red berries are conspicuous during the fall and early part of the winter, and make it a deservedly popular ornamental tree. There are several varieties of the European Rowan Tree, *Pyrus aucuparia*.* The American one, *P. americana* is at its best in our latitude. It becomes a shrub farther south, and extends far north to the shores of James Bay.

LEGUMINOSÆ.

The Kentucky Coffee Tree, *Gymnocladus dioica* or *canadensis* is far from home in this latitude. There is only one specimen, so far as I know, growing in the city. It is on the Normal School grounds on Elgin St., but there are several at the Experimental Farm. This tree is remarkably homely in winter. Its smaller branches are so thick and blunt, and its leaves so late in coming out that it has earned the title, *Chicot*, the dead tree, among our French-Canadian neighbors. But, in summer its leaves are characteristic and beautiful. It is one of the very few trees that produce doubly compound leaves.

The only other large tree that produces such leaves is the Honey Locust, *Gleditsia triacanthos*. It grows at the Experimental Farm and is marked as half-hardy.

The Common Locust, *Robinia pseudacacia* would be far more valuable both as a shade tree and for its timber if it could be effectually protected from the ravages of boring insects. There is almost an avenue of these trees near Rockcliffe, and the street is appropriately named, Acacia Avenue, but it is a rare tree in other parts of the city. Some say it is not a beautiful tree in winter. Its bark is deeply furrowed, and inclined to scale; the trunk is often twisted, the branches are irregular and contorted and twiggy. The seed-pods hang on the tree all winter.

(To be continued.)

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* One member here stated that all the mountain ashes about the city belong to the introduced European species, and that it is even spreading to nearby woods.

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REVISION OF THE SILURIAN OF SOUTH-WESTERN ONTARIO.

By M. G. WILLIAMS.*

At the 1912 meeting of the Paleontological Society of America; Professor Charles Schuchert read a paper entitled "The Cataract, a New Formation at the Base of the Silurian in Ontario and New York." During the summer of 1912 the writer was engaged by the Geological Survey of Canada in revising the Silurian of Manitoulin Island and Georgian Bay, and was with Professor Schuchert during his field observations in these regions. A preliminary statement of the results of the work will appear in the Summary Report of the Geological Survey of Canada for 1912. In the meantime, it may be stated that the "Cataract" formation in the Georgian Bay region consists of two very distinct divisions—a lower dolomite member 11 or 12 feet thick near Collingwood, and 50 feet or more in thickness on parts of Manitoulin Island: and an upper shale member of varying thickness.

For the dolomite division of the Cataract formation the name "Manitoulin member" is proposed, because of its importance on Manitoulin Island. Here it rests upon soft green shale at the top of the Richmond formation. At Cabot Head 6 feet or more of soft, red shale intervene between the green Richmond shale and the base of the Manitoulin dolomite.

The red clay-shale, which forms the upper division of the formation on Manitoulin Island, is well exposed along the road between the villages of Kagawong and West Bay, at a locality north-east of Kagawong Lake. For this division, the name "Kagawong member" is proposed. In the Manitoulin region the Kagawong shale is overlain by about 6 feet of green shale about 6 feet thick which appears to grade upward into the argillaceous dolomite of the Lockport formation. At Cabot Head probably 16 feet of firm red shales underlie soft red clay-shale similar to that on Manitoulin Island. Firm red shale, containing bryozoa, overlie the Manitoulin dolomite along the south side of Georgian Bay. According to the interpretation of the writer, all the red shales are to be included in the Kagawong member. The age and complete stratigraphic relations of a considerable thickness of gray to green shales, occurring above the red shales at Cabot Head, are not yet definitely determined, although they may, in part at least, represent a later phase of the Kagawong sedimentation. They are overlain by about 6 feet of green shale beneath argillaceous dolomite of Lockport age, as is the case with the Kagawong shale on Manitoulin Island.

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*Published by permission of the Director of the Geological Survey of Canada.

THE SHADE TREES OF OTTAWA.

(Continued from page 36).

ACERACEÆ.

The Maple family. It is difficult to decide which is the most valuable among so many useful species.

The Sugar or Rock Maple, *Acer saccharum*, probably ranks first because of its well known and valuable qualities. It is among the finest forest trees, and it is handsome and thrives well in the city as long as there is not too much dust and coal smoke. The bark is rugged or shaggy with deep long furrows; the trunk is straight and opens into a shapely oval outline. It is a slow-growing tree, but long-lived.

The Black Sugar Maple, *A. nigrum*, grows near the city and may grow along the streets, but it is difficult to distinguish it in winter.

The White or Silver Maple, *A. saccharinum*, is one of the commonest, and is deservedly popular. It is a fast grower. The trunk soon divides into 3 or 4 secondary stems with an upward sweep, from which side branches droop outward and downwards. The bark on the branches is smooth and of a light grey color until of considerable size. Both in poise and outline this tree suggests the elm, and the method of city pruning increases the effect. It is one of the first trees to blossom in the spring.

The Norway Maple, *A. platanoides*, is an introduced species and deservedly ranks high. The leaves resemble the Sugar Maple, but are thicker and of a darker green. They remain on the tree a week or more longer than the other maples, and fall without turning color. The petioles exude an acrid milky juice which coagulates. This is characteristic, and is a test easily made. The bark closely resembles the White Ash. On the upper limbs it is of a brownish-grey color. The trunk is apt to divide too low into numerous small branches, forming a broad, rounded head. At an early stage it should be pruned well up.

The Red or Swamp Maple, *A. rubrum*, is somewhat allied to the White Maple. It is also a soft maple and a rapid grower. It does not grow to such a large size, and its branches are more upright. It is in its native home in the forest that it appears in all its glory and sheds its characteristic halo of beauty over all the autumn woods. The Red Maple is appropriately named. Its first blossoms flush to a bright red before the leaves appear, the keys ripen scarlet in June, its leaves swing on scarlet stems all summer, and its young twigs are reddish, and in autumn its leaves turn a magnificent scarlet before they fall, and there is a characteristic tinge of red in the bark in the winter.

The Striped Maple, *A. Pennsylvanicum*, and the Mountain Maple, *A. spicatum*, hardly attain to the dignity of trees.

The Box Elder or Manitoba Maple, *Acer negundo* or *N. aceroides*, comes last in value among the maples as a shade tree. It grows very rapidly, and for this reason it may be grown as a protection for more valuable trees. The trunk divides into several wide-spreading branches and numerous long straggling branchlets. This is the only maple that has compound leaves. These leaves have no beauty in the fall. And the pendulous bunches of keys remaining on the tree all winter are not attractive; and sooner or later its thicket of branchlets so cut off the light that the whole tree has to be cut down.

SAPINDACEÆ.

The well-known Horse Chestnut, *Æsculus hippocastanum*, is a handsome tree in summer, but in the winter is homely. It is recognized by its large terminal buds, which are covered with a resinous gum. The branches have the double compound curve, and the terminal twigs point upwards. This tree is much more common in Toronto and other western cities. We might well have more of them here.

TILIACEÆ.

The Linden, or Basswood, tree may be considered famous in that it gave its name to the father of the great botanist, Linneus (or in its Swedish form, Linné).

Our species, *Tilia americana*, deserves to be planted more frequently in the city than it is. It has a fairly characteristic outline. The large trunk gradually tapers as it gives off numerous side branches with a double compound curve. The trunk is not lost until fully two-thirds way up in the oval-columnal outline of branches. The leaves are larger and unequal-sided. The flowers come out in June and are very sweet-scented, and attract large numbers of honey bees.

The European Linden, *T. europea*, is distinguished by its smaller and more regularly heart-shaped leaves.

OLEACEÆ.

The family is represented by the Ash, *Fraxinus*, of which the common White Ash, *F. americana*, is the best species. The bark is a brownish-grey tinged with red. It is furrowed on old trees, but smoother on the upper branches. This is a forest tree, but is well adapted to city life. Its lower branches have the compound curve. They can be pruned off, and leave a tall, columnar stem reaching above the highest dwellings and casting a grateful shade.

BIGNONIACEÆ.

Represented by the Catawba or Catalpa, *C. speciosa*. The bark is very rugged. The pods remain on the tree all winter and appear to be longer in the cultivated tree than in the wild one. They grow nearly a foot long. The fragrant flowers grow in an erect terminal panicle somewhat like the horse-chestnut, and are very beautiful. Two large specimens of this tree grow in front of the porch at Rideau Hall.

There are two trees, both closely related to the evergreens, that deserve to be more commonly planted as shade trees. One is the European Larch, *Larix Europea*, which is of a deeper shade of green than our native larch, *L. laricina*; its needles are a trifle longer, its branches droop more, and its cones are longer, and have more scales.

Finally, the Japanese Ginko tree or Maidenhair Tree, *Ginko bilobata*, although a slow grower, is quite hardy and deserves special mention as a shade tree. The terminal twigs are upright. In summer, when clothed in its bright green, thickish leaves, it is indeed very beautiful. The leaves somewhat resemble the leaflets of ourMaidenhair Fern, hence its common name.

USEFUL WILD PLANTS OF CANADA.

BY J. W. EASTHAM, B.SC.

With a flora so extensive and as yet so little studied from an economic point of view as that of Canada, it is reasonable to expect that future investigation will bring to light many plants of economic value amongst those which at present we do not consider useful. A brief account indicating the richness of our flora in such useful plants, even with our present knowledge, may help to stimulate interest and enquiry in this direction.

FOOD PLANTS. Our supply of such important fruits as Cranberries, Blueberries and Huckleberries is derived largely from plants growing without cultivation, while the Wild Raspberry and related species of *Rubus* and the June or Service-berry (*Amelanchier*) are also well known and appreciated. Such nuts as the Butternut and Hickory must also not be omitted. Most, however, of our other wild fruits and nuts will not be considered by most people satisfactory substitutes for our common cultivated ones. There is, however, one large group of food plants almost ignored by the majority of people, namely, the Fleshy Fungi. Most people classify these plants into one particular kind which they term "*the* mushroom" and lump the rest together under the name of "toadstools," a name intended to imply properties if not actually poisonous at any rate more or less disagreeable. This is unfortunate since many of these fungi are as good for table purposes as the Common Mushroom (*Agaricus campestris* L.) and some of them are much more abundant in many places or at certain times of the year, *e.g.* the Morels (*Morchella*), the Fairy Ring Mushroom (*Marasmius oreades*), the *Lepiotas*, the Coral fungi (*Clavaria*), the Shaggy Mane Coprinus and others. No doubt the fact that certain fungi are very poisonous has caused the whole group to be viewed with suspicion, but with a very little trouble it is possible to recognize at sight at least a dozen common and delicious kinds.

Another plant which may be mentioned here is the Wild Rice (*Zizania*), the large seeds of which are esteemed by many as a delicacy. If due care is taken in the selection of a suitable locality and in the introduction of the seeds or plants, it is fairly readily established, and apart from any value it possesses in supplying an article of human food, it affords food and shelter for water fowl wherever it may be desired to encourage them.

FODDER PLANTS. There are many situations in which the natural plants will probably always have to be depended upon for fodder purposes, as being better adapted to their environment than any likely to be introduced, as, for example, the Marsh or Cord grasses (*Spartina*) of the Salt Marshes of the Maritime Provinces and the Buffalo Grasses (*Bouteloua*) and Western Rye Grass (*Agropyron tenerum* Vas.) of the West. It is also possible that amongst the great variety of Western leguminous plants some will be found of special value as forage plants.

DRUG PLANTS. A large number of plants are credited in a greater or less degree with medicinal properties, from such popular remedies as Burdock and Dandelion to officinal drug plants like Golden Seal (*Hydrastis canadensis* L.) and Seneca Snake-root (*Polygala Senega* L.) and *Rhamnus Purshiana* DC., a British Columbia plant from which the well-known Cascara

Sagrada is obtained. In certain localities these drug plants may be sufficiently abundant to make the collection of them remunerative, although in most cases the plants are specially cultivated for the preparation of a drug on a commercial scale. In such cases it is necessary to reproduce as nearly as possible the natural environment of the plant. While there is a considerable demand for drug-plants on the part of many wholesale firms and druggists, it may be said that with the present high price of labor in Canada the cultivation of drug plants is not likely to prove very remunerative, and the collecting and drying of the wild plants is in most cases a somewhat precarious source of income. In addition to these plants of established medicinal value we have in our native flora plants belonging to the same genera as certain drug plants of the Old World, *e.g. Arnica*, *Aconitum*, and some of these may be found to be of value for the same purposes, while again, other drug plants of foreign origin as the Henbane (*Hyoscyamus niger* L.) and the Thorn-apple (*Datura Stramonium* L.) have become established in certain localities. In connection with medicinal plants mention must be made of the Ginseng (*Panax quinquefolium* L.). This plant is not now valued very highly by the medicinal practitioner of western countries, but is regarded as possessed of almost supernatural virtue by the Chinese, with whom there is an extensive demand for it at very high prices. It is a native of the rich, cool woods of Eastern Canada, but owing to its scarcity and slowness of growth those who wish to profit by its high market value will find it necessary to cultivate it.

HONEY PLANTS. As the desirability of bee-keeping as a source of income receives greater recognition, the subject of honey-yielding plants becomes one of importance. While there are probably no wild plants in this country which occur in such masses as to influence the location of apiaries in the same way as the Heather moors do in Britain, the Basswood (*Tilia americana* L.) is exceedingly valuable and so to a less degree are the Maples (*Acer*), and an adjacent "bush" of this kind is a valuable adjunct to an apiary. The planting of these trees for ornamental and shade purposes where bee-keeping is followed can, therefore, be recommended. The Boneset (*Eupatorium perfoliatum* L.), a common plant of swampy ground, is a very heavy yielder of honey, and its growth in such places should be encouraged, but although many other wild plants are valuable sources of honey it is probably not worth while to cultivate or encourage the growth of them in preference to such plants as white clover, buckwheat or orchard trees and bushes which are of so much more use in other ways.

In addition to those already mentioned there are other wild plants which find employment in various ways, as, for example, the Sugar Maple (*Acer saccharum* Marsh) whose sap yields maple syrup and maple sugar, the Wild Bergamot (*Monarda fistulosa* L.) often cultivated in gardens for its fragrant essential oil, Wintergreen (*Gaultheria procumbens* L.) yielding the well-known "oil of wintergreen," the Cherry or Sweet Birch (*Betula lenta* L.) which also yields the same oil, and whose sugary sap when fermented gives Birch Beer, while closer study will possibly reveal amongst our native flora, fibre plants of commercial value.

EARLY WINTER BIRD NOTES: 1912-13.

BY L. McI. TERRILL, ST. LAMBERT, QUE.

Though winter conditions set in fairly early, during the latter part of November, lengthy intervals of mild or rainy weather have left us at present (January 25th) with very little snow—perhaps an average of three or four inches—many wind-swept fields being practically bare.

The following notes are from two localities: Montreal, and Bury, a village in Compton County, 125 miles east of Montreal. This latter place is in the heart of a hilly, well-wooded district, where the snowfall is more uniformly retained and birds are more evenly distributed than in the level, wind-swept and sparsely-wooded district about Montreal.

My walks, in the vicinity of Montreal, were taken chiefly on the south shore of the St. Lawrence.

HERRING GULL, *Larus argentatus*.—Seen almost daily above the river, at St. Lambert, until January 12th, when the last bird was noticed.

GOLDEN-EYE, *Clangula clangula americana*.—Both of these ducks fairly common on the river near Laprairie; last seen January 12th.

CANADA GOOSE, *Branta canadensis canadensis*.—Last seen at Bury, December 13th, when two flocks of four and five birds flew south over the St. Francis River.

CANADA SPRUCE PARTRIDGE, *Canachites canadensis canace*.—One shot December 9th, at Bury. (Becoming quite scarce in this district).

CROW, *Corvus brachyrhynchos brachyrhynchos*.—One heard at Bury, December 14th. December 18th, saw about 35, singly, and in companies of two and three, at several points between South Stukely and Montreal. December 29th, commonly noted throughout the day at Ahuntsic, a few miles from Montreal. Though there was a considerable flock in this locality, I have not seen them elsewhere near the city. Probably the many fields of uncut corn, fringed with woods in the background, offered the best food and shelter. Following their tracks near the woods I came across several places where the Crows had uncovered the two or three inches of snow from clusters of Sumac seed (probably *Rhus glabra*). The same tracks led me into a second-growth thicket where a greater depth of snow had been removed from other piles of sumac debris. Apparently it was not chance that led the birds to the dozen or more isolated clusters of seed. As a parallel instance, I have seen piles of potato parings and other refuse, in ditches by railway tracks, exposed in hollows in the snow at a depth of six inches. Have crows a well-developed sense of smell? On the other hand the abundance of fruit panicles adhering to sumac shrubs seem to be untouched by the Crow, though I have seen Robins, in late fall, feeding on them, and Grouse and Pine Grosbeaks, during the winter.

BLUE JAY, *Cyanocitta cristata cristata*.—December 13th, one heard at Bury; apparently unusually scarce; at least very seclusive.

NORTHERN HAIRY WOODPECKER, *Dryobates villosus leucomelas*.—Noted daily at Bury during my stay in the locality from December 9th to December 17th inclusive. December 15th, Bury; watching one at work 30 feet from the ground, was surprised to see it fall, an inert bundle, to pick up its fallen prey from the snow. Occasionally noted at Montreal to date.

DOWNY WOODPECKER, *Dryobates pubescens medianus*.—About as numerous as *villosus*.

ARCTIC THREE-TOED WOODPECKER, *Picoides arcticus*.—First seen near Montreal on October 6th. Last noticed December 1st (3 birds).

NORTHERN PILEATED WOODPECKER, *Phlœotomus pileatus abieticola*.—Bury; seen or heard daily from December 9th to 17th. Their cackling calls were usually heard during or preceding mild weather. Several times saw their tracks in the snow encircling the bases of trees. A common permanent resident in this district.

PINE GROSBEAK, *Pinicola enucleator leucura*.—First seen at Montreal, December 1st. Fairly common to present date.

Very common at Bury, December 9th to 17th. December 15th, watched one extracting seeds from cones of White Pine trees; at the same time heard two singing from the tops of neighboring pines.

REDPOLL, *Acanthis linaria linaria.*—Not seen at Bury until December 14th; a few noted between that date and December 17th. Scarce at Montreal; noted small flocks on two dates only, December 29th and January 1st.

GOLDFINCH, *Astragalinus tristris*.—As notable by its presence as is the absence of the Redpoll. Bury; commonly noted daily from December 9th to 17th, generally in small flocks, sometimes singly. One evening, after dark; I brushed the lower branches of a Balsam in passing, and disturbed a Goldfinch, which tumbled out of its bed and went dipping away. As it flew, the sudden note of alarm was instantly followed by the musical flight notes. The Goldfinch has scarcely a harsh note in its repertoire and therein differs from the Redpoll. Montreal, December 29th, one flock of from 20 to 30 birds seen feeding on seeds in tops of Yellow Birches.

SNOWBIRD, *Plectrophenax nivalis nivalis.*—Bury; noticed several times in small flocks from December 9th to 17th. Montreal; first seen November 3rd; very common from that date to the present time. On November 10th unusually large numbers were seen near Laprairie, roughly estimated at 4,000 birds. They were feeding amongst grass and low weed growth about a chain of shallow surface pools. Continually shifting their position, small bands were constantly in view. As I slowly approached they kept bobbing into sight, from 15 to 25 feet ahead of me, alighting again after a short flight. It seemed incredible that so many conspicuously-colored birds could be so effectively concealed in the scanty growth, and it was only when an individual, plover-like, raised its wings above its head, that I discovered some of them squatting closely. Nearing the ponds I saw that the main body of birds were feeding about the margins—some of them wading into the water with a see-saw, sandpiper-like walk. Whilst thus feeding the chorus of notes reminded me strongly of the twitter of a flock of Bank Swallows about their nesting-place. As the birds arose, by little bounds, they invariably uttered the usual tremulous twitter, followed, on the second bound, by a single lark-like note.

NORTHERN SHRIKE, *Lanius borealis.*—Montreal, January 1st. Saw one fly to perch in tree-top. As I approached it again flew in a northerly direction, but almost immediately swerved upwards and turned due south, in zig-zag pursuit of several Redpolls.

BROWN CREEPER, *Certhia familiaris americana*.—Montreal; three or four seen December 1st, and five on January 19th. Bury, December 9th to 17th; noticed daily; generally only two or three noticed in a flock, though there were probably usually more, as it is difficult to detect all in a flock.

RED-BREASTED NUTHATCH, *Sitta canadensis*.—Bury, December 9th to 17th; noted daily in considerable numbers. Seen more commonly on ridges of White Pine. During mild weather I was often attracted to flocks of this species, sometimes numbering fully 75 individuals, by their chorus of insistent call-notes—scarcely a well organized chorus, however, pronouncing their views with various degrees of feeling—at times a veritable babel. This species spends much more time amongst the foliage in tree-tops than the White-breasted. It is a common permanent resident in the vicinity of Bury—of course numbers may migrate, but enough remain to make it a common bird.

GOLDEN-CROWNED KINGLET, *Regulus satrapa satrapa*.—Montreal; last seen December 1st.

ROBIN, *Planesticus migratorius migratorius*.—Bury, December 10th; two plainly seen and heard chirping. Robins are usually gone from this locality by the end of October. Have only two records for November and none later. Montreal; last seen November 3rd.

I have omitted mention of the ever-present Chickadee and the Owls—of the latter I noticed only the Barred and Saw-whet at Bury.

MEETINGS OF BOTANICAL BRANCH.

Held at the home of Mr. James M. Macoun, Saturday evening, April 19th, the following members being present: James M. Macoun, G. H. Clark, A. Eastham, A. E. Attwood, R. B. White, Mr. Honeyman, Dr. M. O. Malte, J. R. Dymond, J. J. Carter, F. E. Buck and L. H. Newman.

Mr. Macoun reviewed Dr. L. H. Pammel's "Manual of Poisonous Plants" as follows:—

THE POISONOUS PLANTS OF CANADA.*

While it is not possible to summarize in a few paragraphs an exhaustive work of nearly a thousand pages, a general idea of the nature and scope of Dr. Pammel's† book can be given and special reference may be made to the various kinds of vegetable poisons and the species or groups of species of plants which are most injurious to man and other animals. An idea of the completeness with which Dr. Pammel's work has been done may be gathered from the fact that 1,097 books and papers are enumerated in the bibliography of poisonous plants which concludes the volume.

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*Part of a Summary of Pammel's "Manual of Poisonous Plants" made for the Botanical Branch of the Ottawa Field-Naturalists' Club, by J. M. Macoun. Published by permission of the Director of the Geological Survey of Canada.

The introductory chapters deal with Bacterial Poisons; Dermatitis or skin diseases caused by plants; Forage Poisoning, Ergotism and Aspergillosis, the latter caused chiefly by moulds; and Poisoning from Fungi. It is, however, chiefly plants of the higher orders that will be referred to in this summary and only the commoner or best known species, the order followed in their enumeration being that of Engler and Prantl and Gray's Manual.

The only fungi that need be mentioned are of the genus *Amanita* of which *A. muscaria*, Fly Agaric, and *A. phalloides*, Death Cup, are the commonest and most dangerous species. As distinguished from the ordinary mushroom, both species have white gills and a bulbous base, while the mushroom has pink or brownish gills and is without a bulbous base. Both species of *Amanita* grow usually in woods or along the borders of woods and seldom on lawns or in open fields. There are no ferns that are known to be very injurious to animals, although some are suspected of being so, but *Equisetum arvense* when in large quantity frequently poisons and sometimes kills horses. This has been proved by recent experiments, but fortunately it seems to be only the dried plant that is injurious. Hay which contains much *Equisetum* should not be used either for food or bedding. Many grasses are poisonous under certain conditions, but recent research shows that much of the poisoning that has been attributed to grasses is due to fungus growths rather than to the grasses themselves. *Lolium temulentum*, Poison Darnel, has long been known to be poisonous, its effects being usually seen when it is ground up with wheat. Some species of *Araceæ* such as *Acorus Calamus*, *Symplocarpus fœtidus*, *Calla palustris* and both species of *Arisaema* are acrid and under some conditions poisonous. Only a few species of liliaceous and orchidaceous plants are poisonous. *Zygadenus* frequently poisons sheep and other stock in the west, but so far as experiments have gone only before the plants flower, and animals are usually killed by eating the leaves, or more frequently the bulbs, before the plant has blossomed in the spring. The local name for *Zygadenus* is in many places "Lobelia," and cases of poisoning are so common in Oregon and Nevada that the term "lobeliaed" has been used to indicate the result from this kind of poisoning. In one band of sheep 2,000 were poisoned and 100 died, in another 200 were poisoned and 90 died. *Zygadenus* is common is southern Alberta and throughout British Columbia. *Veratrum viride*, American Hellebore, is well known to be poisonous both to man and animals, but as the plant is acrid it is not relished by stock; young animals sometimes eat it with fatal results; chickens have been killed by eating the seeds. *Trilliums* have long been considered poisonous, and the roots are certainly emetic. The fruit should be regarded with suspicion. The underground roots of *Iris versicolor*, Blue Flag, are known to be very poisonous. As the roots are very acrid there would be little danger of their being eaten were it not for the resemblance of the commoner name to that of Calamus, Sweet Flag; if eaten it would prove seriously if not fatally poisonous. It was not until 1875 that it was discovered that at least two species of *Cypripedium*, *C. hirsutum* and *C. pubescens*, produce dermatitis very much resembling that produced by Poison Ivy. Prof. MacDougal's experiments with stems and leaves upon individuals have shown that more than half of them were affected. It was discovered that these plants are provided with glandular hairs which cover the whole surface of the stem and leaves and contain a poisonous oil which is especially abundant at the fruiting season. Later experiments by Nestler have shown that *C. hirsutum* is by far the most poisonous species.

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†Manual of Poisonous Plants, by L. H. Pammel, *Ph. D.*: The Torch Press, Cedar Rapids, Iowa, U.S.A.

Many species of *Ranunculaceæ* are poisonous, but the genus *Delphinium* is the only one to which the poisoning of stock in large numbers has been directly traced, and, in Alberta, *D. glaucum* has done the most injury to cattle. It is in the early spring, before green food is abundant, that the worst effects are noticed and experiments have also shown that the plants are more poisonous at that time. Observations in the United States have also shown that very frequently after a light snow-fall other vegetation is covered and larkspur, being the only green food, is eaten. Sheep are not often affected by this species probably because they are not on the high ranges where it grows at a time when more palatable food is not to be had. *D. Menziesii*, however, which grows in southern Alberta and throughout British Columbia is often eaten by sheep. Of 600 sheep that were affected on one range in Montana in May, 1897, 250 died. Other species of Canadian *Delphiniums* are nearly, if not quite, as poisonous as the two mentioned above, but, except on Vancouver

Island, do not grow in quantity where they are likely to be eaten by cattle. All the species of Aconite are more or less poisonous, but no injury to cattle has been recorded. *R. sceleratus* is the most dangerous species of the genus *Ranunculus*, growing as it does in marshes and along ditches where cattle are likely to eat it with other forage plants; it is also the most poisonous species. The juice of several species will, if rubbed on the skin, produce blisters and sometimes ulcers.

Although the berries of Mountain Ash, *Pyrus Aucuparia*, are poisonous to man, *Prunus* is the only rosaceous genus that causes serious injury either to man or stock. The leaves of all the species may be eaten while fresh, but when wilted contain a virulent poison, hydrocyanic or prussic acid. *P. serotina* is the most poisonous species in the north, although *P. pennsylvanica* and *P. virginiana* are almost equally so. Poisoning is frequently caused by cattle and sheep eating the wilted leaves, and children occasionally die from eating the kernels of the seed. So many sheep are killed by browsing *Prunus* leaves when being driven along trails in the west that in many places the bushes have been cut out, in others the dangerous places are marked by flags. Leaves wilted in bright sunlight to about 75 per cent. of their original weight, or until they appear slightly limp, yield the maximum amount of prussic acid.

Many of the *Leguminosae* are injurious to stock and it is to this family that all the "loco weeds" belong. Of these, in Canada at least, *Oxytropis* causes the greatest damage to sheep, horses and cattle. No Canadian species of *Astragalus* is known to cause injury. One effect of eating any of the "loco weeds" is that a depraved appetite is developed and the animals prefer the "loco weed" to wholesome food, and will even dig up the roots to satisfy their craving. The first stage of the disease is the effect on the nervous system, which in time drives the animal frantic; in the second stage there is emaciation, exhaustion and finally death from starvation. *Thermopsis rhombifolia*, which is common in the prairie country, is said to be injurious to stock, and several cases of children having been poisoned by eating the seeds are recorded by the Canadian Department of Agriculture. It is only in recent years that it has been shown that poisoning from lupine occurs almost always when the plant is fruiting, and experiments in Germany have shown that the active poison, ictrogen, is found chiefly in the seeds and pods. It is after the first frosts destroy other vegetation that the lupine is eaten in the greatest quantity. Of one band of 200 sheep let into a field of lupine for a short time when in a hungry condition, 100 had died within a few hours and 50 others succumbed later on, and on another occasion 150 rams were given a feed of lupine hay and during the night 90 of them died. In the first instance the lupine pods were fully formed but the seeds not ripe; in another case 1,150 sheep died out of a band of 2,000, and in still another 1,900 out of 3,000. The first symptom after eating lupine is excitement followed by frenzy and then spasms and falling fits. In many cases death occurs within an hour. The common lupine in southern Alberta is *L. argenteus*, one of the most poisonous species.

Poison Ivy, *Rhus Toxicodendron*, is known to everyone, though comparatively few people are affected by it. No case of poisoning among the lower animals has been recorded. Of the many cures recommended for Ivy poisoning the best is powdered sugar of lead dissolved in a 50 per cent. solution of alcohol. Various methods for the destruction of poison ivy patches have been tried; the certain way is, of course, rooting it out, but covering with tarred paper creosoted below is said to be effective and Dr. Pammel recommends pouring a solution of two pounds of commercial sodium arsenic to 10 gallons of water around the roots. Whether *R. Vernix*, Poison Sumac, *R. diversiloba*, Poison Oak, or *R. Toxicodendron* is the most poisonous has not yet been determined.

The family *Umbelliferæ* contains the best known and most poisonous plants, at least in the east, and the resemblance of innocuous species to those that are deadly poison has caused many deaths. *Conium maculatum*, Poison Hemlock, though not indigenous is a common species in waste places. Poisoning has arisen from eating the seed for that of anise, the leaves for parsley and the roots for parsnips, also from blowing whistles from hollow stems; many domestic animals have been killed by eating the plant. All the species of *Cicuta*, Water Hemlock, are very poisonous, especially *C. maculata*, Cowbane, in the east, and *C. vagrans* in the west; many cases of human poisoning, especially among children, have been recorded, the roots being mistaken for those of edible plants such as parsnips, horse-radish and artichokes; stock of all kinds are frequently killed, generally in the spring, when the ground is soft and the roots pull up easily. The deadly nature of the root has been shown by cutting one in small pieces, mixing it with carrot and feeding to a two-year-old heifer. It died in an hour and a half, though only a small portion was eaten; two grams were found in the stomach. A further experiment made with the same lot of roots showed that it was only when in the dormant state that they were poisonous. After some of them had been grown a month in a greenhouse they were found to have no injurious effect at all. So many persons believe the wild parsnip, *Pastinaca sativa*, to be poisonous that it is well to record the fact that there are no authentic cases of such poisoning. Many experiments on man and other animals has proved conclusively that no ill effect results from eating the roots. The flowers and leaves do, however, sometimes produce dermatitis when brought in contact with damp skin, some persons are also affected by the carrot in the same way.

One would hardly expect to find poisonous plants among the *Ericaceæ*, but all the species of *Kalmia* are very poisonous, and *K. angustifolia*, Sheep Laurel, and *K. latifolia*, Mountain Laurel, destroy many sheep and cattle, and chickens are said to have been poisoned by eating the vomited matter from poisoned animals. The flesh of partridge is said to be rendered poisonous when the birds eat the buds, and honey derived from the nectar of the flowers appears to be poisonous. Many of the Solanaceous plants are more or less poisonous, but the genus *Solanum* is the only one that causes much injury. The berries of *S. nigrum*, Common Nightshade, are often cooked for food, but when green are poisonous to man, and cattle are poisoned by eating the leaves of either this species or *S. Dulcamara.*

A few species of *Compositæ* are poisonous. Among these *Senecio Jacobaea* has done the greatest damage, though its bad effects on cattle seem so far to be confined to parts of Nova Scotia and New Brunswick, where it is supposed to be the cause of what is known as Pictou disease. It is most dangerous in its young state. *Helenium autumnale* also occasionally causes death when eaten by cattle, and many genera such as *Artemisia* and *Tanacetum* are poisonous to man if the volatile oils are taken in large doses. *Eupatorium urticæfolium*, White Snake Root, is generally believed to cause the "trembles" in cattle, horses and sheep and milk sickness in man. The trembles cause many deaths among cattle, and butter and cheese made from the milk of affected animals is poisonous to man. Until quite recently there seemed to be no doubt that *Eupatorium* was responsible for the trembles, but recent investigators do not believe this to be the case unless it should be at times the carrier of some pathogenic organism. The pollen of several composite plants such as ragweed, goldenrod and chrysanthemum are said to cause hay fever. *Ambrosia artemisiifolia* is regarded as specially troublesome as an exciting cause with reference to hay fever. There is as yet, however, no conclusive proof that hay fever is ever caused by pollen or that pollen has any greater irritating effect on the air passages of sensitive people than any other dust of an organic character.

In the discussion which followed the above review some interesting observations were made as to the action of various plants which were believed to produce poisonous effects in man or beast.

The common rhubarb was claimed by Mr. White to be exceedingly poisonous during the early stages of its growth when the early shoots were only an inch or two in length. The poisonous element here was believed to be oxalic acid, which, in the young shoots as well as in the tissue of the leaf, is very prevalent.

In discussing the effects of *Equisetum* (Horse Tail), reference was made to a statement in the book in question which claimed that this plant produces the same effect when fed to cattle as that produced by mouldy corn, viz., diarrhœa.

Reference was made to the claim by Freeman that *Lolium temulentum* is poisonous in one part of the United States and not in certain others.

An example to show the poisonous effects of *Zygadenus venenosus* Wats. on sheep, in southern Alberta, was cited by Mr. Clark.

In Lupines and certain other plants the seeds rather than the vegetative parts of the plants are poisonous.

In the well-known loco weed (*Oxytropis Lamberti*) barium is generally believed to be the poisonous element.

Water Hemlock was believed to be the most poisonous plant of all those belonging to the family Umbelliferae.

The Common Wild Parsnip was shown to produce dermatitis quite in the same manner as poison ivy and certain other plants.

In discussing the peculiar effects of *Ledum palustre*, Dr. Malte referred to the fact that the European form of this plant was used during the pre-Christian era in Scandinavia in beer to produce a certain effect.

An interesting experience was cited by Mr. White in connection with the common elderberry which had produced an intense secretion of saliva.

The Wonderberry, which is said to be a cross between certain western forms of *Solanum Nigrum* was claimed by some to have a poisonous effect, although the author of the above book seemed to think otherwise.

Seeds of *Lychnis Githago* were believed to be poisonous to poultry, although in Scandinavia and Russia these seeds are eaten by boys without any apparent effect.

Reference was made to an experiment at the Poultry Department of the Ontario Agricultural College at Guelph, Ont., where screenings were fed to poultry with injurious effects.

Reference was also made to an experiment in feeding common mustard seed to animals for a long period of time, which resulted in the production of ulcers and blisters which were believed to be identical with the blisters formed by the applicaton of mustard plasters.

Before the meeting ajourned Dr. Malte outlined the work which had been done by Prof. Macoun, Mr. James M. Macoun and himself in the production of a new "Ottawa Flora" and expressed the hope that the Botanical Branch would co-operate in seeking to perfect this work. He believed that each member of the Branch could assist very materially by specializing on a certain genus and in this way bring together information which might be of great value in connection with this work. He also thought that excursions of the Branch might be held to advantage. These excursions were not to take the place of the ordinary excursions of the Club, but would rather be supplementary to these. Excursions by a few persons desiring to do exact work would, in his opinion, contribute most to our present knowledge of the flora of the Ottawa district. The ordinary excursions of the Club are concluded just at a time when special work can be done to best advantage so that there should be no difficulty in arranging for this extra work.

Mr. Macoun offered an excellent suggestion to the effect that the meetings of the Botanical Branch should continue until the excursions are finished, a meeting being held on each evening of the Saturday on which the excursion took place. By this arrangement there would be an inducement for members of the Branch to attend the excursions for the purpose of collecting specimens which might be used as a basis for discussion at the evening meeting. As a beginning in this direction Dr. Malte agreed to discuss "The Plants of the Season" at a meeting of the Club on Saturday evening, May 3rd, an excursion of the O.F.N.C. being held on that day.

L. H. NEWMAN.

Held at the home of Mr. R. B. Whyte, Saturday evening, May 3rd, the following being present: Messrs. Whyte, Carter, Attwood, Dwight, R. Campbell, Dymond, Malte, J. M. Macoun, Newman.

An account of the different species and forms of violets growing in the vicinity of Ottawa was on this occasion given by Messrs. Macoun and Malte. The study of the wild violets to which this spring much attention has been paid by the said gentlemen has proven to be extremely interesting from many a point of view. At the meeting of the Club the members present were given an opportunity to study the characters of the different species on living specimens collected in the field and by the obliging kindness of Mr. R. B. Whyte, kept in pots for the meeting.

The discussion was opened by Mr. Macoun, who explained that many species are now recognized which had at first been lumped under one species or variety known as *V. cucullata* or

V. palmata var. *cucullata*. This fact, and the number of the species into which this group was subsequently divided, is explained in an article published by Mr. Macoun in a former number of THE OTTAWA NATURALIST.*

In connection with this discussion the interesting fact was brought out that practically all of the forms, first separated in the field by Mr. Macoun and described by Dr. Edward L. Greene, of Washington, D.C., have proven to be quite worthy of the species-rank given them by Dr. Greene.

Dr. Malte defined the different groups of violets as found in the vicinity of Ottawa and illustrated, by means of the specimens mentioned, the differences which are to be found between these groups. It was explained that the violets in this group belong all species with leafy stems and which produce flowers in the axils of the leaves. Under the second group are placed all species, the flowers of which are borne on peduncles produced directly from rootstocks (acaulescent violets).

From the first group two sub-divisions can be separated, one of which has *entire stipules* and the other *fringed stipules* and blue or violet flowers. In the first sub-division three well-defined species are found, namely, *V. pubescens* Ait, *V. scabriuscula* Schwein and *V. canadensis* L. To the second of these sub-divisions the following four species belong, namely, *V. labradorica* Schrank, *V. conspersa* Rchb., *V. rostrata* Pursh and *V. leucopetala* Greene.

Regarding the latter species the opinion was expressed that it might possibly better be regarded as an albino form of *V. conspersa* than a species proper.

Under the second main group of violets, namely, the acaulescent or stemless forms, two divisions are made. Under one division are placed all stemless violets having a fleshy and thickened rootstock without runners, while in the second division are placed those species, the rootstocks of which are long and filiform and generally produce slender runners.

The following species belonging to the first division of the stemless violets were demonstrated at the meeting, viz., *V. cucullata* Ait, *V. sororia* Willd, *V. septentrionalis* Greene, *V. Macounii* Greene, *V. venustula* Greene and *V. Fletcheri* Greene.

Of these only the three first mentioned are recognized as good species in the last edition of Gray's Manual of Botany. *V. venustula* is considered synonymous to *V. affinis* Le Conte. However this may be, the plant described by Dr. Greene as *V. venustula* is a very clearly defined species, flowering two weeks

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*Notes on Some Violets, *Ottawa Naturalist*, 1899, pp. 181-187.

or more later than the other acaulescent violets.

V. Macounii is not mentioned in Gray's Manual. It is, however, a well defined species, growing on limestone foundation. It differs from all other acaulescent violets in having *all* petals hairy on the inside. (The other species have at most three petals hairy on the inside).

Regarding *V. Fletcheri*, its specific value is less clear and the opinion was expressed that it might turn out to be *V. septentrionalis* out of place.

Under the second division of the stemless violets, i.e., those which possess rootstocks which are long and filiform, seven species have been recorded from the Ottawa district. Of those the following were demonstrated and explained at the meeting, viz., *V. pallens* (Banks) Brain, *V. blanda* Willd and *V. renifolia* Gray.

The specimens of *V. pallens* presented at the meeting were collected at Blueberry Point by Messrs. Macoun and Malte. When collecting the specimens it was noticed that among the typical plants were growing individuals, characterized by having much larger flowers and by being much hairier all over. In other respects they resemble *V. pallens* very closely, and the opinion was expressed that they represent a hairy variety of *V. pallens* not sufficiently distinct from that species to be considered a species of its own.

An interesting discussion took place regarding the biology of violets, it being explained that while, in the acaulescent species, seed usually was produced from cleistogamous flowers developed after the showy spring flowers had disappeared, it was occasionally found that plenty of seed could be produced by the spring flowers which generally are sterile. Such a phenomenon had been observed, during one season, by Mr. Macoun to be qnite frequent in *V. Macounii*.

One of the most interesting features in connection with the discussion of the evening was the exhibit and examination of a strange form which was believed to be a hybrid betweeno *V cucullata* and *V. septentrionalis*. An examination of the pollen by Dr. Malte had shown that at least 90% of this was undeveloped. Undeveloped pollen is an indication of hybridity.

Before closing the discussion, Dr. Malte announced that Mr. Macoun and he were arranging to study the different species and forms of violets during the fruiting season, and to note any peculiarities which might be utilized in distinguishing the different species. Any observation of value might be used, if necessary, in connection with the key to the genus, which key, it was hoped, would be available for distribution before the violet season opens next spring.

L. H. NEWMAN.

EXCURSIONS.

The first excursion of the year was held to Rockcliffe and vicinity on Saturday, May 3rd.

Owing to the warm weather of the previous two weeks, a large number of spring flowers were found. Hepaticas were almost gone, but *Claytonia virginica*, *Erythronium americanum*, *Trillium grandiflorum* and *T. erectum*, *Dicentra canadensis*, *Caulophyllum thalictroides*, *Uvularia grandiflora*, *Asarum canadensis*, *Dentaria diphylla*, *Viola pubescens* and *V. canadensis* were quite common. *Ranunculus abortivus*, *Sambucus canadensis*, *Thalictrum dioicum* and *Mitella diphylla* were also collected.

The Tent Caterpillars were just becoming prevalent.

At 5 o'clock short talks on collections made were given, at the pavilion, by Messrs. Halkett, Dymond, McGillivray and Carter and Miss Matthews. J. R. D.

The second excursion was held to Leamy's Lake, Hull, on Saturday afternoon, May 10th. The day was rather cold, there having been severe frost during the previous night.

The party divided into three groups, with the following leaders: Mr. Halkett, Zoology; Dr. Williams, Geology; Mr. Newman, Botany. At 5 o'clock the divisions re-united for the usual talks by the leaders. Mr. Halkett spoke on Daphnia, a fresh-water crustacean, and of a species of Helicoid or air-breathing mollusc. Dr. Williams discussed Brachypods and Trilobites. In Botany, the interesting find was that of *Viola rostrata*, a rather uncommon species, by Miss Ruth Burpee. Other violets collected were *V. pubescens*, *B. scabriuscula*, *V. canadensis* and *V. conspersa*. J. R. D.

BIRD NOTES.

On December 18th, 1912, while driving through the hills north of Kaladar Station, Lennox County, Ont., I saw a flock of seven or eight Canada Jays. When I next visited the same locality, January 28th of this year, although I kept a sharp look-out, I did not observe any; but a few days later, some distance south, I saw one flying about in a farmer's barn yard. It will be interesting to know whether these birds have been observed as far south in other parts of the province. None have been noted near Kingston, Ont.

On February 12th the first flock of Pine Grosbeaks was observed at Kingston, and on the 23rd, Evening Grosbeaks.

ED. BEAUPRE, KINGSTON, ONT.

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DESCRIPTION OF A NEW SPECIES OF TESTUDO, AND OF A REMARKABLE SPECIMEN OF STYLEMYS NEBRASCENSIS, FROM THE OLIGOCENE OF WYOMING, U.S.A.*

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The specimen of Testudo to be described below is one of a small collection of turtles from the Oligocene of Wyoming, U.S.A., lately acquired by the Geological Survey, Canada. The collection, consisting altogether of ten well preserved specimens, was made by Charles H. Sternberg and C. M. Sternberg, in 1911, at Seaman's old ranch, Sage creek, a branch of Old Woman creek, Niobrara county (formerly included in Converse county), Wyoming. The majority of these specimens, with the exception of the one regarded as representing an undescribed species of Testudo, are for the present referred to *Stylemys nebrascensis*, Leidy.

The principal character distinguishing this Testudo from other species of the genus is the great development of the epiplastral lip which forms a very conspicuous feature of the plastron.

Of the known species of Testudo which shew a decided enlargement of the epiplastral lip, *T. thomsoni*, Hay, from Oligocene deposits in South Dakota, U.S.A., approaches most closely to the Sage creek form. *T. thomsoni* was described by Dr. O. P. Hay, in 1908, in his monumental work on North American turtles[1] from "the skull, the greater portion of the anterior lobe of the plastron, some cervical vertebræ, and parts of the left foreleg" . . . . "obtained in 1904, by Mr. Albert Thompson, of the the American Museum of Natural History,

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*Communicated with the permission of the Director of the Geological Survey, Canada.

[1] The Fossil Turtles of North America, by Oliver Perry Hay, Washington, D.C. Published by the Carnegie Institution of Washington, 1908.

New York, at Corral Draw, in Ziebach county, South Dakota" . . . . "in a block of limestone which had come from the Lower Oreodon beds." A comparison of the imperfect anterior lobe of the plastron of *T. thomsoni*, the only portion of the shell of this species known, with the corresponding part of the plastron of the Sage creek specimen discloses in the latter the much greater proportionate size of the epiplastral lip and differences throughout in the proportions of the elements forming the lobe.

The Sage creek specimen consists of the carapace and plastron in a good state of preservation. The sutures between the bones are clearly seen and the sulci indicating the boundaries of the scutes are distinct. The carapace has been injured in the neighbourhood of the eighth neural, and that bone is missing. The plastron has been crushed in between the inguinal notches with the result that in this portion of the shell the sulci and sutures have been partly destroyed. The fractured humerus of both of the fore limbs protrudes from the rock which fills the axial notches, and the distal ends of the tibia and fibula of the left hind leg are exposed in like manner behind.

The carapace has been slightly flattened and its breadth in this way increased to some extent, but as it now is the maximum breadth is 410 mm. and the greatest length 479 mm. It rises 120 mm. from its lateral margin to the centre. Viewing it from above, its breadth decreases more rapidly forward than backward, so that the posterior is greater than the anterior half and has a squarer outline. This is caused mainly by the enlargement of the peripherals above the hind limbs. The lateral peripherals and the pygal continue the general convexity of the shell downward at an increased angle; the peripherals in front are produced almost horizontally forward toward their free edges whilst the more posterior lateral ones are only moderately inclined.

The nuchal bone measures 90 mm. along its free margin in front. It broadens slightly backward to its maximum breadth of 103 mm. and then rapidly narrows to its full length of 95 mm. It is notched behind to receive the front edge of the first neural.

Of the eight neural bones the first is the longest; it is much longer than broad, narrows toward the front, and its outline is convexly rounded in front and behind. The second is hexagonal with the two short sides directed backward, and the front and back edges incurved or concave. The third is quadrangular, longer than broad, with its front edge convex and the hinder one straight. The fourth, fifth, sixth and seventh are hexagonal with their two short sides directed forward.

There are two suprapygal bones of which the first is deeply notched behind, with the forks in contact with the pygal and the eleventh peripherals. Its surface is broadly convex in all directions and has a maximum breadth behind of 102 mm., with a length, measured from its sutural junction with the pygal to the centre of its front margin, of 84 mm. The second suprapygal is diamond shaped, slightly longer than broad, and more pointed in front than behind. The surface of the pygal is longitudinally and transversely convex, broader in front than behind, with a length slightly exceeding the front breadth; its dimensions are—anterior breadth 62 mm., posterior breadth 47 mm., length 70 mm.

The second, fourth, sixth and eighth costal bones are greatly expanded distally, with a resultant decrease in the distal breadth of the third, fifth and seventh costals. The proximal end of the second costal abuts against the first and second neurals, and the third is in contact with the second, third and fourth neurals. The proximal ends of the seventh and eighth costal bones came within the area of injury, which has resulted in the loss of the eighth neural and the posterior half of the seventh, and are missing.

The first and third vertebral scutes are about as broad as long. The sulcus marking the back border of the third curves sharply forward in the centre whilst crossing the fifth neural. The second and fourth vertebral scutes are slightly longer than broad. The fifth vertebral is greatly expanded behind and its lateral sulcus passes down the midlength of the tenth peripheral bone. The nuchal scute is 34 mm. long and 26 mm. broad. The supracaudal scute is 145 mm. broad behind at the free border of the shell, and 73 mm. long in its middle line, its anterior sulcus crossing the second suprapygal 15 mm. in advance of the centre of the latter's posterior margin. The dimensions of the neural and costal bones and vertebral scutes are given in mm. in the following table:—

Neural bones			Costal bones			Vertebral scutes		
No.	Length	Breadth	No.	Proximal breadth	Distal breadth	No.	Length	Breadth
1	68	44	1			1	100	97
2	40	47	2	36	94	2	77	82
3	41	34	3	52	22	3	78	88
4	37	48	4	40	85	4	—	82
5	36	45	5	39	17	5	—	162
6	34	44	6	35	73			
7	—	44	7	—	19			
8	—	—	8	—	67			

The plastron has a length of 493 mm. Its most conspicuous and interesting feature is the greatly extended epiplastral lip which projects 28 mm. beyond the line of the front margin of the carapace. The entoplastron is roughly five sided, and is sharply pointed in front with its maximum breadth far back; its hinder edge is broad and slightly convex. It measures 86 mm. in length and 90 mm. in breadth. The anterior lobe is 163 mm. long, with a breadth of base of 229 mm. The posterior lobe is 147 mm. long, and 239 mm. broad at the base. It is divided behind by a V shaped notch, 40 mm. deep, on each side of which the free border curves rather broadly round to the side. Throughout the plastron the free border comes to an acute edge.

The anterior lip has a length of 72 mm., in advance of a line drawn between the outer termination of the gulo-humeral sulci; its breadth is 98 mm. It is 19 mm. thick on each side of the deeply impressed gular sulcus and thins outward to the acute lateral border. On the upper surface it is more convex transversely than beneath, where it ha sa flat slope outward from the midline. It maintains the same breadth forward from the base to near the front, where it ends in two apices widely separated by a V shaped notch 22 mm. deep. The border within the notch is smooth and thick, but on either side in front it is thin and irregular.

The gular scutes appear to extend on to the entoplastron, but the sulci here are not preserved. The humero-pectoral and the pectoro-abdominal sulci cross the plastron 25 mm. and 59 mm. behind the back edge of the entoplastron respectively. The pectoral scutes are thus very narrow, meeting along the midline of the plastron for a distance only of 34 mm. The abdomino-femoral and the femoro-anal sulci are not preserved toward the centre of the plastron, but measured between their outer terminations the abdominal scute is 131 mm. long from front to back, near the bridge, and the femoral scute has a length of 85 mm. at the free border.

The characters revealed by the Sage creek specimen place it in the genus Testudo. The great enlargement of the epiplastral lip distinguishes it from all other described species of the genus. Another interesting character is the extreme differentiation of the costals in breadth, an alternation in the size of which is found in a greater or less degree in some species of Stylemys as well as of Testudo. The neurals, as a series, more nearly approach those of Stylemys in shape than those of Testudo, in which there is usually an alternation of octagonal with tetragonal neurals. The first, second, third and fourth neurals and their manner of contact with the three anterior costals are somewhat after the pattern found in *Testudo laticunea*, Cope, from the Oligocene of Colorado.

Regarding the present specimen as representing an undescribed species of Testudo, the name *præextans*, having reference to the marked prominence and size of the epiplastral lip, is here proposed for the species with this specimen (Cat. No. 8401) as the type.

In plates I and II, shewing the carapace and plastron respectively, the sutures between the bones and the sulci marking the boundaries of the scutes are well shewn and can be readily traced.

Of the specimens belonging to the collection of turtles from the Oligocene of Sage creek, mentioned in the opening paragraph of this paper, and regarded as referable to *Stylemys nebrascensis*, Leidy, one in particular is of interest.

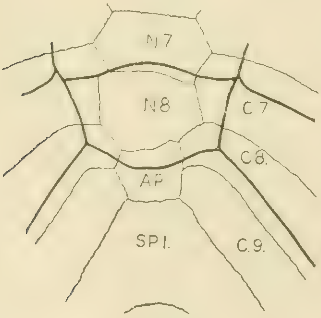
In this specimen certain abnormalities occur in the carapace which are considered of sufficient importance to warrant description. The plastron appears to be quite normal.

The shell as a whole has been somewhat distorted. A horizontal pressure on the left side has caused the left costal bones to be unduly bent down and the bridge peripherals to be incurved below. The plastron has been moved to the right and pressed upward along its longitudinal midline. Otherwise the specimen is splendidly preserved. The carapace is 276 mm. long and 215 mm. broad in its present state; its highest central point is about 119 mm. above the lower edge of the peripherals near the bridge. Plates III and IV, reproduced from photos graphs, shew the carapace and plastron with the bones and scute clearly defined and reference need only be made here to the divergence of the carapace from the normal type of structure.

In the carapace there are seven costal scutes on each side instead of the usual four, and an additional vertebral scute between the fourth and the broad posterior one. Also an accessory bone occurs between the eighth neural and the first suprapygal, and there is a ninth pair of costal bones.

With the exception of the above structural peculiarities the carapace conforms to the usual type of *S. nebrascensis*. The first neural bone is of an elongated quadrangular form, and the succeeding ones are hexagonal. The costal bones shew a slight differentiation in distal breadth. The marginal bones reach the usual number of eleven on each side, as do also the marginal scutes. There are two suprapygal bones, of which the first is bifurcated behind; the second is diamond shaped and much broader than long. The nuchal scute is extremely narrow. The supracaudal scute is undivided. These characters are normal to the species.

As regards the peculiarities of structure in the carapace of this individual. The first costal scute is the largest, but its hinder sulcus has been crowded forward to some extent. The succeeding six are narrow antero-posteriorly, and take the place of the large second, third and fourth costal scutes which occur in nearly all fossil turtles with the exception of those belonging to the Trionychoidea. The first and second pair proceed outward on either side from the second vertebral scute, the third and fourth pair from the third vertebral, the fifth and sixth pair from the fourth vertebral, and the seventh pair from the accessory fifth vertebral. The relative position and size of the bones of the carapace and of their overlying scutes can be best understood by reference to plate III. The costal scutes correspond exactly on either side of the shell in each pair. The second, third, fourth, fifth, sixth and seventh measure distally, in an antero-posterior direction, 39, 26, 29, 26, 28 and 38 mm. respectively. The sulci between them pass down the second, third, fourth, fifth, sixth and seventh costal bones. The hinder sulcus of the seventh scute is on the eighth costal bone in advance of the latter's hind margin. The additional vertebral scute is small in comparison with the others, is broadest in front, and measures 28 mm. in length and 44 mm. in breadth anteriorly. Its front sulcus crosses the seventh neural and the hinder one the accessory plate.



N. 7, N. 8, neural bones 7, 8;
AP., accessory plate;
C. 7, C. 8, C. 9, costal bones 7, 8, 9;
SP. 1, first suprapygal bone.

The accompanying text-figure, one-half the natural size, shews the shape, relative size and position of the bones and scutes of the carapace in the neighbourhood of the additional vertebral scute, the boundaries of the scutes being indicated by the heavy outlines.

The seventh neural bone is hexagonal, but differs from the preceding hexagonal ones with two short sides directed forward, in having its four lateral margins about equal. Both the eighth neural and the accessory plate are slightly irregular in shape. The eighth has six sides, of which two are short and are directed obliquely backward. The accessory plate is hexagonal with two short sides toward the front, and it joins the preceding eighth neural in an irregular manner, as shewn in the figure. The eighth pair of costal bones are in contact with both the eighth neural and the accessory plate.

The ninth pair abuts proximally against the accessory plate only.

The neurals of *S. nebrascensis* shew variations to a limited extent. In the majority of specimens of this species the second and succeeding neurals are hexagonal with the maximum breadth well forward. In the type of *Testudo culbertsoni*, Leidy, now generally regarded as properly referable to *S. nebrascensis*, the second neural is octagonal and the third quadrangular; also there is an additional bone between the eighth neural and the first suprapygal. The presence of a ninth pair of costal bones, seven pairs of costal scutes and an additional vertebral scute is considered to be, in the specimen from Sage creek, a unique example of extreme individual variation. So far as the writer is aware, in no turtle, belonging to any of the groups having large epidermal scutes in the carapace, has so great a development of vertebral and costal scutes hitherto been recorded.

EXPLANATION OF PLATES.

Plate I—Carapace of *Testudo præextans*, viewed from above; one-fourth the natural size.

Plate II—Plastron of the same shell, inferior aspect; one-fourth the natural size.

Plate III—Carapace of *Stylemys nebrascensis*, as seen from above, to shew the abnormal number of costal and vertebral scutes etc.; one-half the natural size.

Plate IV—Plastron of the same specimen, inferior aspect; one-half the natural size.

IS BARTRAM'S SANDPIPER DISAPPEARING FROM THE PRAIRIES?

Twenty years ago the Bartramian Sandpiper (*Bartramia longicauda*) was a common summer resident on the prairies of Alberta, but for the past ten years it has become one of our rarest birds, at least in central Alberta. During the summer of 1892 and several years following one could see a dozen pairs in as many miles. About the year 1900 I did not see this many in a whole season, and from that time until the present they have gradually become rarer each year until this present season I have only seen one pair.

I cannot find a reason for this disappearance, and I would like to have the experience of other observers of this bird given in the NATURALIST.

F. L. FARLEY, Camrose, Alberta.

THE BROAD-STRIPED SKUNK.

(*Mephitis hudsonicus* Rich.)

By Norman and Stuart Criddle.

The subject of this article, including its various races and relations, covering the continent, has a reputation that none will envy and few appreciate until they come into actual contact with the animal in its vicious moments, when, closely pressed and in danger of death, it gives forth that fetid odor for which it is notorious.

In modern times it has become an instinct to consider that the name skunk implies an animal wholly obnoxious, and in consequence the name itself has become synonymous of all that is odious and depraved. The impression arrived at is, of course, due to lack of knowledge combined with the far too common practice of exaggeration. We hope in this little sketch to dispel some of these notions and to prove by the narrative that although the odor is very real, it is not necessarily a part of the animal's every-day life.

The Broad-striped Skunk was, in days gone by, a common mammal in Manitoba, and at our home at Aweme its numerous encounters with coyote, dog and probably owl, often impregnated the air with an unsavory odor which was far from pleasant. As time went on, however, conditions changed and constant persecution greatly reduced its numbers, so that to-day we have but a remnant of what went before, although the animal seems to be holding its own fairly well in the less-settled districts.

There are few handsomer mammals than skunks in this part of the world, and of the whole genus few, if any, equal the species under discussion. Unlike the eastern animal its stripes of white along the back are broad and prominent and show up strikingly in contrast to the black. In addition, it has a large white patch at the back of its head and a narrow stripe down the nose which often varies sufficiently to enable one to be separated from another; besides this there is the magnificent tail which almost wholly hides the back when held over it. Skunks in many respects are not unlike weasels; this is particularly so of the head, but the body increases in width towards the tail in such a manner as to give the animal a wedged-shaped appearance when viewed from above. In gait they are clumsy. The walk is a wabble, and in running they gallop. They are by no means fast in movement and it seems that the immunity afforded by the terrible weapon of self-defence has been to some extent acquired at the expense of speed, or possibly with such a weapon speed is no longer necessary.

In preparing for her young the female skunk seeks out some hole or covered place, such as that afforded by a barn or old building, where she can make her way beneath the foundation. She then locates a convenient grass patch where the old growth lies thickly and by means of her long claws rakes this up into bunches and drags it to her burrow, always moving backwards, by which means the long claws are used to full advantage. Several nights are occupied over this work and a vast amount of grass taken in before she becomes satisfied. In this nest are born several young, six probably being an average. Here they are reared and remain out of sight for some little time. Later they follow their mother in her wanderings after food, but it is quite late in the season before they finally separate; indeed, on some occasions they are said to winter in the same burrow.

Our species seems to be an almost omnivorous feeder, readily devouring anything in the animal line from an evil-smelling bug to a rabbit, while various fruits as well as ordinary vegetable matter is consumed. Nor must we forget eggs, of which they are very fond. But the choicest titbits of all seem to be insects; grasshoppers are taken wholesale and eaten with the utmost relish. If it were not for their habits of raiding poultry houses and their fondness for eggs it seems probable that skunks would be classed as almost wholly beneficial, but on account of these habits death is unfortunately often a necessity as it is practically impossible to drive them away. We have known them to take eggs from beneath a brooding hen without disturbing her, and likewise young chickens; at other times fully grown poultry were killed, but as a rule these are not molested when eggs or young are available. In winter time such food as is eaten must be made up almost wholly of rodents and vegetable substances. We have little evidence under this head, but on one occasion, at this season, a freshly cleaned out home revealed much Horsetail (*Equisetum*), which suggests that this plant was used for food and that perhaps, like weasels, skunks store up food for future use.

With reference to the powerful odor for which the animal has become celebrated, much misconception prevails. We are usually led to believe that this scent is carried about as a sort of attraction, not unlike some people's scent bottles, and that a liberal amount is sprinkled over the animal for that purpose, but as a matter of fact nothing is further from the truth, and to meet an odoriferous skunk is as unusual as it is objectionable. In reality they are by no means anxious to part with their perquisite and only do so when closely pursued and when life is endangered. When such emergencies arise, however, they make full use of this weapon, and woe to the enemy that gets in its way or stands within thirty feet of the line of fire. It is not, however, the skunk that carries the odor thereafter. To show how sparingly such a defence is resorted to we may relate that the junior writer has on various occasions trapped skunks and that in no instance did they make use of it. While more than once he actually liberated them and permitted them to run off without even an indication of unpleasantness, which is more than can be said of most mammals. But, kill one, no matter how suddenly, and the scent glands seem to be at once released, causing the yellow fluid to be scattered broadcast, accompanied by that never-to-be-forgotten odor.

Like the badger and the bear, skunks appear to sleep fairly constantly during the winter months and only emerge from their burrows occasionally; there is seldom a week, however, that they do not show signs of activity, though long journeys are seldom indulged in before March.

The males do not seem to take any part in the family welfare and on this account are seldom met with, in fact, there is even reason to suspect that they are undesirable visitors near the home and that they might perchance make a meal of a newly born young if opportunity offered, though we have no direct evidence in favor of such a supposition.

On June 10th, 1912, a family of skunks was located beneath the foundations of an old building and as we wished to study their habits the junior writer set to work in the endeavor to catch them. He commenced operations by placing a shallow tin of bread and milk close to the burrow, to which the skunks proved very partial, and ate readily. It was but a short time before they appeared in his presence, and within ten days they had become sufficiently tame to readily partake of the milk while under observation. Did he get too close however, the mother angrily demonstrated her displeasure, and with hair erect and tail well over her back made short jumps towards him hitting the ground a sounding blow with her fore feet.

On June 23rd a trap was devised consisting of an apple barrel sunken in the ground, with a collapsible top, this latter being level with the surface and covered sufficiently to look natural. At dark some bread and milk was placed on the opposite side from the burrow, while the trapper waited events close at hand. As was their nightly custom, the young skunks soon appeared, and with that instinctiveness for which all wild mammals are celebrated, made a careful inspection of the trap. They would move carefully a little way on, and then back off again, repeating the manœuvre a number of times, until finally they went round and soon had their noses in the milk. It was not long, however, before one, getting a little alarmed, made a short cut for its home, forgetting the trap in its haste, and promptly fell in. The watcher then deliberately pushed in another with his foot. Meanwhile the mother, observing that all was not well, remained at the entrance of her burrow thumping the ground continuously with her feet. It being now dark, however, operations were suspended until next morning, when the mother and another baby were found secured, the parent having evidently been trying over night to release her children and fallen in in the attempt. The old one was not, however, a desirable acquisition, so she was helped out by means of a board and at once made her way to the remaining young, and finding them safe brought them out in broad daylight to eat the freshly placed bread and milk, the night exertions having evidently made her hungry as well as fearless, as she showed no regard for the observer within reach, who taking advantage of his nearness picked up another small one and placed it with its captive companions, thus making four and leaving two for the mother.

To those not familiar with skunks and having regard only to the story-book tales, these proceedings will be thought somewhat risky, but as a matter of fact they were amply justified by the results, the captures and all connected with them being accomplished with no more fuss than if the captives had been kittens and as if the celebrated odor had formed no part of them.

While the mother continued for a time to reside beneath the building, the young were placed in a box within which they remained until the end of August when, becoming pugnacious, or too rough in their play, they were transferred to a room some twelve feet square, in which they were able to romp with impunity. They soon became extremely tame, and apart from always being at the door at meal-times, would race round and round the visitors feet in their eagerness to get at the food. Nor did they hesitate to rear and set their front feet upon an outstretched hand to secure the titbit offered. They would also permit being taken up without protest, though this practice was never to their liking. In the morning they were often in a playful mood and would jump and thump the floor in pretended anger, but it was at night when they were seen to full advantage. Then, quite regardless of a lantern, they would run about, frisk and climb eagerly up to shove their noses greedily into the bread and milk-pail before we had even time to place it upon the floor. There was a resemblance to a pig in these actions, particularly in the habit of shoving each other with their shoulders to retain the dish for themselves, but otherwise they lapped up milk much as a cat does. With bread they either grabbed it with their teeth, or putting both feet in the pail made quick jerks backwards.

usually upsetting the contents, when they would draw a lump into a corner, always with the same characteristic backward movements.

Grasshoppers invariably proved a great treat, and being abundant, were sometimes collected in large quantities with the aid of a sweeping net, but never in sufficient numbers to appease the appetite of our hungry pets. It was particularly interesting to watch them catch the living ones. Moving slowly forward they sniffed about until one was located, when they immediately pounced upon it with their fore paws, and speedily took it within. Moths too were relished and were often chased round the lantern and not infrequently knocked down with the feet as they fluttered past. Twice the senior writer discovered a prowling Lion Beetle (*Calosoma calidum*) which, in spite of the strong odor peculiar to this species, was greedily devoured. Rabbits, when divided, were partaken of with relish, so were gophers and mice, and many a fight was witnessed over them, as our friends invariably desired the same portion, and in their endeavors to secure it would pull, snap, squeak and whistle, as well as shove with all their might, but eventually each was provided with a portion and would retire to a separate locality to devour it. Their hunger being thus appeased, they would curl themselves up together on their bed of hay until the shades of night produced renewed animation and activity.

Repeated experiments demonstrated that insects formed the most palatable food, next came meat in its various forms, and after this vegetable matter such as cherries (*Prunus pennsylvanica* and *P. virginica*), also carrots, raspberries, strawberries, acorns, broad beans (green), wheat heads, wild buckwheat (*Polygonum*), lamb's-quarters, peas, grass and various other vegetable substances too numerous to mention.

Our pets continued to flourish and grow until the end of September, when they were almost fully developed. At this time one became unwell with what appeared to be a sort of distemper, and in spite of every care, got rapidly worse and died without a struggle. A few weeks later another took sick and shortly after all had died. Two of these were magnificent creatures at the time of their death and but a few days previous had been at the height of activity and health as well as extremely fat. The senior writer had at that time held two of them up in his arms while they, with a total disregard for what was going on, were both ardently engaged in a battle to see which should get its head in the bread and milk can first. The very next day they were ill, and a few days afterwards were dead, from a cold that seemed to lead to sleep and from sleep to death. We were all very sorry to lose our pets, particularly our sister, who had tended them almost daily and given them various titbits. All the horror which the name skunk implied had vanished and in its place we found a pretty, attractive animal, surpassed by few in cleanliness. When they were attended to and their house kept thoroughly clean, little, if any, of that odor for which they are famous was discernible.

The mother remained about for some time, but eventually acquired a habit of visiting the poultry house and stealing the chickens. She was trapped by the junior writer, but given her liberty again in the hope that the lesson would prove sufficient. She remained perfectly quiet while being released, and only by persistent chasing could be made to leave the premises, which she did at last without any reminder that would suggest a skunk. Returning a few days later she encountered the dogs, much to their discomfort and ours, but even this did not restrain her from her nightly raids, so eventually necessity obliged us to make away with her. As a parting, she left a by no means desirable legacy, which remained in evidence for at least a couple of months afterwards.

Of the two remaining young little is known, but from the fact that a dog met with a somewhat hasty check near the old home late in the season we have reason for hoping that at least one has survived.

SCARCITY OF BUMBLE-BEE NESTS IN THE VICINITY OF OTTAWA.

Queens of *Bombus terricola*, *ternarius*, *fervidus* and *borealis* were common on the Experimental Farm in the spring, and those of seven other species, *pennsylvanicus*, *perplexus*, *vagans*, *impatiens*, *rufocinctus*, *affinis* (only one) and *separatus* (one only) were observed. During July and early August, however, very few workers were seen and no nests could be discovered. The trial plots of red clover, a plant that never fails to attract large numbers of *Bombi* in Europe, were seldom visited by bumble-bees, though in a red clover field at Danford Lake, Que., numerous workers of *B. borealis*, an uncommon species in the United States, were noticed. Why are bumble-bee colonies so rare around Ottawa? Is it because the queens cannot find suitable nests? Or are they destroyed by parasites or larger enemies, such as skunks? Observations on the nests that have survived might reveal the main cause of the scarcity, and the writer would be very pleased to hear of any nests that may be found in the district or elsewhere, in order that he may make a careful investigation.

F. W. L. SLADEN, Asst. Entomologist for Apiculture, Division of Entomology, Central Experimental Farm, Ottawa.

CORRESPONDENCE.

Editor, The Ottawa Naturalist:

It is with pleasure that I am able to report that for the fourth year in succession "*Tyrannus verticalis*" has migrated hither. A pair are now (May 26) looking over last year's nest with a view to re-occupation. Probably they are the original pair. In any case, they are far more welcome than their cousins, *T tyrannus.*

H. M. Speechly, Pilot Mound, Man.

NEST OF BELTED KINGFISHER.

A nest of this species with the eggs and parent bird has been acquired by the Canadian Fisheries Museum. The nest is from Meach Lake, Gatineau District, P.Q., and was found by Mr. Alex. C. Finlayson, Inspector of Fish Hatcheries, and his son, on 24th May. It was situated in a sand-pit about 10 feet from the ground and about 3 feet from the top of the pit. An excavated tunnel about 8 feet in length led from the entrance to the nest—the diameter of the entrance being about 2½ inches, and the extremity of the tunnel, where the nest was, was dome-shaped, and about 8 inches across and some 6 inches high. The nest was placed on the sand of the pit, and was merely composed of clean fish-bones and scales, upon which was the full complement of eggs—7 in number, fresh, semi-spherical, and pure white, only that their contents before being blown gave them a pinkish hue. The parent bird, which was found in the burrow, is the male, which lacks the chestnut band across the breast characteristic of the female. The nest, eggs and bird, when together exhibited in the museum, will form a graceful object.

Belted Kingfisher (*Ceryle alcyon*). "This is the familiar bird whose loud, coarse, rattling notes are heard along our streams. It may be seen perched upon the lower branches of a tree overhanging the water or on the top of a dead stump; these places furnish a favorite outlook, from which it plunges beneath the water to secure its prey, which is chiefly fish. It is a curious fact that Mr. W. E. D. Scott frequently met with this bird in the desert region of Southern Arizona, far from water, feeding on the large insects and lizards." (Oliver Daire, in "*Nests and Eggs of North American Birds.*")

Andrew Halkett.

OCCURRENCE OF THE COTTON MOTH IN ONTARIO IN 1912.

By ARTHUR GIBSON.

The first record I have of the occurrence of the Cotton Moth (*Alabama argillacea* Hubn.) in Canada, in 1912, is its abundance at Woodstock, Ont., where the moths appeared on the evening of October 9th, or morning of the 10th. Mr. James Dunlop, who reported the flight, stated that he first saw them on an electric light pole near the Canadian Pacific Railway Station, soon after 8 a.m. Many specimens were on the pole and on the ground nearby. Visits were then made to other electric light poles in the vicinity. An immense number of the moths were seen on and near the second pole. "The pole was on one side of the sidewalk and on the other side under some trees among the grass, the moths were covering everything. They could have been literally shovelled up. There was a large flock of hens that had also discovered them, but they did not seem to make the least impression in their numbers. Next morning very few were to be seen, just an odd one here and there."

In the Canadian Entomologist, April, 1913, a short note was published, chiefly to accompany an illustration made from a photograph of a flight taken at London, Ont., by Mr. J. F. Calvert. With the photograph, Mr. Calvert sent the following note: "Late Thursday night, or early Friday morning (October 10th-11th), there appeared in London, great numbers of the Cotton Moth. They were most noticeable around the Canadian Pacific Railway Station, the Grand Trunk Railway Station, the Grand Trunk Railway Round House, and at a few other points where powerful arc-lights were located. In some places there were heaps several inches deep under these lights. By the following Sunday (October 13th) very few were to be seen."

At Dunnville, Ont., a flight was observed in the morning of October 11th. Mr. J. C. Payne, who reported the occurrence, stated that the moths "covered, thickly, the windows and store fronts, and lay on the ground like autumn leaves. There was a rain storm during the night (10th-11th), and the moths were here in the morning, after the rain."

On the evening of October 12th, I saw numbers of the moths in New York City, particularly in store windows and in restaurants.

At Ottawa few specimens were seen, and only during one evening, viz., October 15th, when seven were observed.

EXCURSIONS.

BRITANNIA, May 17th. After a brief address from the President, Mr. Newman, as to plans of excursion, place of meeting for the discussion of specimens collected, etc., the party divided themselves into two groups: botanists and zoologists. The former, with several leaders, went towards Britannia Highlands. The zoologists took the opposite direction, judging the lowlands better suited for the aquatic life which they were seeking.

Notwithstanding the sounds of the woodman's axe and the carpenter's hammer, in clearing for and erecting homes, the denizens of the woods have not yet learned (here at least) to fear the advance of civilization. The squirrels seemed to enjoy the luxury of boarded sidewalks, which form the avenues of the future village.

Not expecting to find many of the early spring flowers, we were surprised to see the trilliums in such profusion, whose beautiful white wax-like petals adorn and beautify any landscape.

The following is a list of the flowers collected: Trillium (*Trillium grandiflorum*), Jack - in - the - Pulpit (*Arisaema triphyllum*), Toothwort (*Dentaria diphylla*), Bellwort (*Oakesia sessilifolia*), Ground-nut (*Aralia trifolia*), Sarsaparilla (*Aralia nudicaulis*), Clintonia (*Clintonia borealis*), Squirrel-corn (*Dicentra canadensis*), Starflower (*Grientalis americana*), Mitrewort (*Mitella diphylla*), Goldthread (*Coptis trifolia*), Corydalis (*C. glauca*), Liverwort (*Hepatica triloba*), Twisted-stalk (*Streptopus roseus*), Maianthemum (*M. canadense*.) Marsh Marigold (*Caltha palustris*). also four species of violets.

The birds seen or heard were as follows: Swallows, robins, red-and-buff-shouldered black-birds, bronzed grackles, a crow, certain sparrows, and a flicker. A burrow of some mammal, perhaps that of a wood-chuck, was seen. The pools contained numerous insects, such as aquatic beetles and hemipterons, a scarlet-coloured arachnid, and an isopod (*Asellus aquaticus*), besides different kinds of pulmonate water snails, such as *Limnæa stagnalis* and *Planorbis*. An interesting insect found was a specimen of *Meloe*, which is related to the blister beetle of commerce. Facts concerning its structure, such as the rudimentary elytræ etc.; life-history, such as how the adult insect feeds on the leaves of the buttercup; the fate of the young larvæ, which are conveyed by bees to their nests, etc., were stated. A few tadpoles, upon one of which the larva of a neuropterous insect was preying ,were shown in a glass jar.

After a most delightful afternoon we returned to the Pavilion, where "Talks" were given by Dr. Blackader, Mr. J. W. Eastham, Mr. A. Halkett, Mr. Newman and others.

A. L. M.

AYLMER. The district around Queen's Park, Aylmer, was the locality chosen for the excursion of the club, held Saturday afternoon, May 31st. It was necessary to change the place of meeting from Ironsides, owing to wrong information having been received about the train service; this caused several to miss the outing. The excursionists left the electric railway landing about 3.30, and after walking through the park, along the railway track and through woods for an hour and a half, they took possession of one of the vacant cottages along the lake to discuss the finds of the day. The specimens most frequently encountered, and one which nature seems to have been making a specialty of for two years, was the forest tent caterpillar. These creatures were everywhere, on leaves, in the grass, on the railroad rails, as well, in fact, as on most of the people, but the other works of nature more than compensated.

Mr. L. H. Newman, president of the club, presided, and also presented the botanical specimens. The district is not especially rich in wild flowers, although a fair number of specimens were collected. A few lady's slippers were found, a number of violet species, the beach pea, bishop's cap, lousewort, shepherd's purse, pennycress and the fruit of poison ivy.

A very interesting talk on the wild fruits of the district was given by Mr. W. T. Macoun, Dominion Horticulturist. Mention was made that in this district there is only one native species of wild plum, the Canada plum, which is hardy, but for many years has not porduced fruit because of the severe attacks of a fungus disease. Some transplanted trees, grown under good orchard culture, are now producing paying crops. This is a striking illustration of the benefits of spraying for the prevention of disease in fruit trees. The native varieties of cherries here are the choke, pin and black. A specimen of the native prickly gooseberry was collected. This species is being used in crossing to breed hardiness into the larger cultivated sorts. Specimens of the common wild black currant and the common wild red raspberry were found. The latter is the species from which most varieties of cultivated red raspberries have been developed. Most of these have been produced in southern districts and are, therefore, not hardy in cold climates. At the Experimental Farm work is being done on the plants found in the locality to produce hardier varieties. Nearly all the cultivated varieties of strawberries too have come from one of the two wild species found here; many of them are tender because grown in a southern district and hardier strains are being developed.

The geology of the district was discussed by Dr. Williams of the Geological Survey. The three distinct types of rock found were blue limestone, sandy shale and 'sandstone. It was explained how the limestone, found along the lake shore, formed in deep water, and the sandstone, further back on higher land, in shallow water with the shale intermediate. An exceptionally fine specimen of sandstone, made of tiny round pebbles cemented together by pressure, was found, and an interesting piece of fossil rock composed almost entirely of snails.

The birds, insects and snails were looked after by Mr. A. Halkett of the Fisheries Museum and Mr. Winterberg of the Geological Survey. Among the birds Mr. Halkett noted the oriole, kingbird, bobolink and song sparrow. The yellow swallow-tail butterfly was seen and a number of small insects and larvæ collected, including the destructive cutworm.

E. D. E.

STITTSVILLE. The excursion to Stittsville on June 14th was the last arranged for by the council for the summer season, and the afternoon's outing was much enjoyed by the goodly number of excursionists. The locality proved to be a rich field for the collector and observer.

Various species of plants were collected under the leadership of the botanists, observations were made of rock formations, and a winding stream visited by some of the members proved to be a regular natural aquarium for the general zoologist.

Mr. L. H. Newman, president of the club, named most of the plants which had been collected during the outing. Among these he showed the tall meadow-rue, bunch-berry, mouse-ear chickweed, silvery cinquefoil, small-flowered crowfoot, star-flower, lady's slipper, clintonia, dwarf raspberry, mitre-wort, twin-flower, cleavers, anemone, and a number of different sedges. He referred to the abundance of silvery cinquefoil and mouse-ear chickweed on the knolls and ridges, where the soil was lighter and inclined to be sandy. This was a good illustration of plant adaptation.

Referring to specimens of *Viola selkirkii* collected during the afternoon, Dr. Malte gave a brief account of the seed formation in the stemless violets. It was pointed out that, as a rule, the showy spring flowers are not able to produce seed, this function being taken over by so-called cleistogamous flowers, *i.e.* insignificant bird-like flowers which are self-fertilized automatically without being opened. These cleistogamous flowers behave very differently in different species, and offer very good characters for their identification. Only occasionally the spring flowers are fertilized, either by pollen from the same species or from other ones. In the latter case the result will be the production of hybrids, characterized by a large per cent. of undeveloped pollen unfit for fertilization. In the vicinity of Ottawa four hybrids between different *Viola* species have been found this spring.

The occurrence of *Antennaria canadensis* (Everlasting) in the district visited induced Dr. Malte to deal briefly with the phenomenon called parthenogenesis, *i.e.* the faculty of egg-cells of certain genera and species to develop the new normal individuals without the assistance of male organs. He pointed out that parthenogenesis in plants was in fact first discovered in a species of *Antennaria*, it having been observed that in this genus, which is diœcious, the male plants generally are extremely rare; and he also referred to a number of other parthenogenetic genera, such as *Taraxacum* and *Hieracium*, and finished his remarks by calling attention to the remarkable investigations on the parthenogenetic development of eggs of sea-urchins and star-fishes, which, during recent years, have been carried out by scientists in the United States and France.

Mr. McGillivray collected specimens of gneiss of a typical gray colour, and also in a decayed state; samples of limestone, red granite, sandstone and a kremoloid; and he also had with him to show specimens of different kinds of minerals which he had previously collected on the island at Chelsea and at the Ironsides mine.

Except in stagnant pools, there has been for years past at the localities which the naturalists have visited, little opportunity for the study of aquatic forms of life, but the stream at Stittsville afforded excellent facilities for such study. The brook is full of small cyprinoids and other kinds of small fishes, besides a great variety of aquatic invertebrates. The fishes netted or observed were these: specimens of Red-bellied Dace (*Chrosomus erythrogaster*), a Minnow (*Leuciscus neogæus*), a small specimen of the Common Sucker (*Catostomus commersonii*), a few specimens of the Brook Stickleback (*Eucalia inconstans*), a specimen of a Darter presumably the Johnny Darter (*Boleosoma nigrum*) or perhaps its variety, the Tessellated Darter (*Boleosoma nigrum olmstedi*), but the specimen was lost before it could be examined; and numerous specimens of a Miller's Thumb (a cottoid) were seen in the stream, but none were netted. One or two specimens of a Crayfish (*Cambarus*), larvæ of a Caddis-fly with their tubes made of broken pieces of wood, one or two tiny fresh-water mussels, and various other aquatic invertebrates were also found in the brook.

The excursions of the season have been a great success, every Saturday has been fair, and the last held, at Stittsville, proved to be one of the most enjoyable and instructive.

A. H.

THE WESTERN GREBE IN ONTARIO.

There have been a good many records of the occurrence of this bird in the province, but probably not one is capable of being substantiated. All those that have been investigated have proved to be the Red-necked Grebe, which is a regular and frequent migrant through all of Ontario, and the uncertified remainder are doubtless of the same class. It is a pleasure, therefore, to put in print a genuine record for which the skin is in evidence.

Some months ago in examining the collection of Mr. J. E. Keays, of London, Ontario, I found an immature specimen of the Western Grebe which had been obtained from Mr. H. D. Carman, about 1892, and which was taken at Sarnia. The date of capture is unknown, but it was in the neighbourhood of 1888.

There is little doubt but that this species, so common in the west, strays into the regions of Lakes Superior and Huron each year, but its numbers would probably be few and only rarely would one be seen or captured by anyone competent to identify it.

W. E. SAUNDERS.

BIRD NOTES.

The following notes were given to me by Mr. I Turner, who has spent the past winter near the "end of steel" on the Transcontinental Railway, about fifty miles east of Cochrane.

WILLOW PTARMIGAN (*Lagopus l. lagopus*). Abundant during the greater part of the winter, from about the middle of December, 1912, to March 20th, 1913. The birds were very tame, and would seldom take wing on the approach of a human being; more likely one of the males would strut ahead of the flock and with trailing wings advance, as if to challenge the intruder.

CANADA SPRUCE PARTRIDGE (*Canachites canadensis canace*). Common, and like the preceding species, very tame.

NORTHERN RAVEN (*Corvus corax principalis*). Common; usually to be found in vicinity of the camps, where they fed on offal and other refuse.

CANADA JAY (*Perisoreus c. canadensis*). Common; another camp-follower.

L. McI. TERRILL.

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DOES THE TYPE OF PROTOPALÆASTER NARRAWAYI PRESENT AN ORAL OR ABORAL ASPECT.

(Plates VIII-IX, Figure 1).

By George H. Hudson.

During my first study of this type, careful search was made for items of evidence for both sides of this question and these items were classified and recorded. The evidence was so long and so overwhelmingly in favor of an oral aspect that it was decided not to burden my paper [A]* with it. In the last paragraph, however, I mentioned three of the most important adverse items, anticipated criticism, and promised a defence of my position. Dr. Raymond uses these items, with others, in favor of an aboral aspect [B]. I propose here to weigh carefully his evidence and present some items which are decidedly against his view.

Infero-Marginals.

I. The vertical radial outlines of the interradial shown in [A] plate II, fig. 4, and in our present text figure 1; together with the transverse vertical outlines seen in [A] plate III, fig. 5; show a markedly convex surface without the slightest degree of summit flattening and such outlines prove conclusively that no interradial supero-marginal ever developed in contact with the exposed surface of these plates.

II. On the orad margins of each of these plates there are three concavities—the central one the most pronounced. They suggest comparison with the hollows or depressions in the plates of Goniasteridae and Linckiidae into which the jaws of the pedicellariae rest when open. Dr. W. K. Fisher writes me that he believes "The impressions are intended to receive the epineural plates," and that they are, therefore, oral surface features.

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*Papers to which reference is made are indicated by capital letters in brackets. A list of these is placed at end of this article.

III. The absence of granular ornamentation on the exposed faces of the arm marginals is about equal in transverse width to the area which would be covered with the opened epineurals. Dr. Raymond, [B] p. 106, lines 42-43, cites this peculiarity as evidence that supero-marginals must have rested over these. In [C] I have published stereograms of three different regions from the undoubted oral surface of Palæaster niagarensis, Hall, which show the same smooth surfaces, and Prof. Fisher writes me that naked areas on these plates "are especially numerous in the Goniasteridae, in the genera Tosia, Goniaster, Pseudarchaster, Plinthaster." The evidence here is at least no stronger for an aboral than an oral surface.

IV. Dr. Raymond, [B] p. 106, lines 38 and 42, calls the exposed surface of the marginals "truncated" and "flat." We have seen that this is far from being the condition of the interradials and in [A] plate II, figures 3 and 4, we may see that it does not accurately describe the arm marginals. The first of these has a fairly well rounded surface, while the second to the fifth possess well marked angles a little orad of the centre of the plates. That these plates were convex on transverse vertical section is also seen in figures 5 and 7 of this plate—note particularly the right-hand side of figure 7.

Photomicrographs made under gum possess a flat lighting that is sometimes very deceptive. My study of such, like the one used in figure 2 of the plate just referred to, led me also to call these plates flat and deny them re-entrant angles for the oral longitudinal muscles. If now we will examine in [A] plate III, fig. 4, the marginals numbered from 2 to 7, we shall see these plates in normal lighting and their appearance is very decidedly that of original free surfaces and against both Dr. Raymond's descriptive terms and his deduction therefrom—that these surfaces were produced by intimate contact with a series of supero-marginals. Many forms, both living and fossil, show a more decided oral flattening of these plates than that revealed in this figure.

V. In our present plate IX, fig. 1, the right hand marginals 5 and 6 are fairly well preserved and the fields of their common flexor clearly outlined both by form and also by the blackened remains of some of their muscle fibers. Such large bundles of flexors would occur only on arm surfaces.

Of the five items given by the marginals the third is of little value and is only included because it formed a part of Dr. Raymond's evidence against an "oral side up" decision. Item IV, when the real facts are given, is for such a decision, and items I, II and V are of a most positive and unequivocal character.

ADAMBULACRALS.

VI. The exposed flat faces of the first adambulacra (mouth plates) dip strongly inward. The true oral surfaces of these plates in Palæaster parviusculus have similar flat faces which also dip inward. See stereogram in [C] plate III.

VII. Prof. Fisher says of the angular ridge towards the furrow, which is shown by all the adambulacrals, "This strongly suggests the attachment area of the 'furrow comb' of spines * * * * such a ridge is quite characteristic of many species. It is well seen in Astropecten, Psilaster, Persephonaster, etc."

VIII. Dr. Raymond says of these adambulacrals [B] p. 105, lines 9-11, "And each plate was provided with a cup-like pit into which the proximal end of a covering plate fitted." He then says of the Urasterella which he figures, [B] 106, lines 1-2; plate VI, fig. 1; that its apparent "Covering pieces" (ambulacra) "are supported by small plates with a pit on top, just as in Protopalæaster narrawayi." Now, in the first place, ambulacra never have their adambulacral ends fitting into cup-like pits to form ball and socket joints. There is, however, a pit or depression between each pair of plates, and this is occupied by the ambulacro-adambulacral muscle. In the second place, the adambulacra now in question do not possess "cup-like pits," but they show angular, flat or slightly depressed muscle fields. In the third place, the proximal ends of the epineurals in P. narrawayi not only do not "fit" these muscle fields, but they *are in every case placed alternately with them*. This is the only evidence that Dr. Raymond deduces from the adambulacrals, and it is too widely at variance with the facts to have been carefully considered. The alternate arrangement just specified is strong evidence against Dr. Raymond's interpretation.

On giving these adambulacrals additional study by means of new stereograms, I am inclined to abandon my idea that the muscle fields in question were for attachment of epineural adductors. The muscle fibers, which remain attached to them, are small and more probably served to open the "furrow combs." In our plate IX, fig. 2, much heavier bundles of muscle fibers are to be seen next the marginals and between adambulacra—note particularly the remains of the bundle between the last two adambulacra on the left. In addition to the evidence given, [A] p. 46, lines 32-37, to show that the epineurals were arranged alternately with the adambulacra, I here present fig. 1 of plate IX. There maining ends of several epineurals are to be seen in place in the left-hand row of this figure, but probably crushed in a little by the force that displaced the epineural below. In figure 2 of this plate it will be seen that the median bosses projecting inwardly from the last preserved marginals do not extend through to the aboral surfaces of the plates, but they served for attachment of the epineurals. We may still see that the 3rd and 4th marginals on the left each possessed two of these bosses though the corner ones have been nearly lost by weathering.

IX. Where adambulacra possess long vertical axes these are usually somewhat imbricated, the oral ends being tipped toward the mouth, never away from it. The broken ends of rays II to V all show this inclination. See stereogram in [C] ray V and our plate IX, figures 1 and 2. The angle of inclination is about 25°. The slight imbrication is an adaptation to secure greater flexibility in the arms and to help in thrusting the food content of the furrow toward the mouth. Such evidence cannot be lightly set aside.

EPINEURALS.

Although asserting that the "covering pieces" had their origins in the pits of the *oppositely* placed adambulacra, Dr. Raymond calls them "alternating plates" (p. 105, line 6). A study of their distal ends is of interest. The younger pieces, plate VIII, fig. 2, meet, though very irregularly, by their end faces. The furrow here is in a contracted condition, and this should have *opened* the end faces, were these ambulacra, and displayed the muscle fields of the transverse dorsal ambulacral muscles. Not the least trace of such muscles is anywhere to be seen.

The older epineurals, following the law of biogenesis, are less like primitive covering pieces and meet only by their inner edges, plate VIII, fig. 1. The fallen 8th, the covered 5th and the two shifted 3rds in this figure indicate that the meeting ends were free.

The varied imbrication of the *sides* of these pieces and the absence of traces of longitudinal muscles is also evidence against their being ambulacra.

The epineurals marked as first could by no possible means have had their distal ends bound to their opposite neighbors. To conceive these first members of a series as ambulacra is therefore wholly out of the question.

The evidence of plate IX, fig. 2, is that the epineurals were borne by the marginals. The latter plates have lost much of their original surface, but there is here and there a suggestion that they also bore large spines outside of the epineurals. For one instance note the structure of the raised central portion of the more perfectly preserved fifth marginal in plate IX, fig. 2. The only spine fragment preserved in the matrix, however, is in interradius 1, but this when magnified about 20 diameters reveals a striated surface as if belonging to a sea-urchin.

VERTICAL SECTION.

XI. The last item of evidence to be here given from the oral skeleton is derived from the sequence and form of outline of the vertical section given in text figure 1.

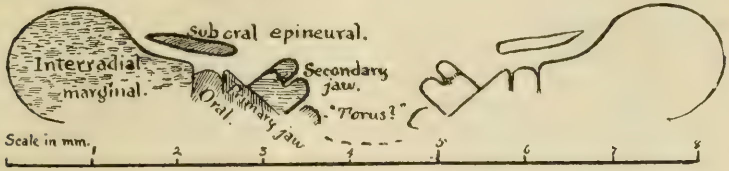

FIG. 1. Outlines from vertical section of P. narrawayi passing in through one interradius to center and out by one of the interradii next the opposite radius. Slight offsets have been made to include suboral epineurals and secondary jaws.

It is not a difficult matter to account for these plates, their form and position, if the outline is that of the true oral surface. If, however, this outline is of the aboral surface of the oral skeleton, we are face to face with an apparently insuperable difficulty. How are we to explain the presence of the deep concavity on the now aboral inner face of the marginal—the large paired plates which now become *supra-orals*—the beveled *interior* faces of the mouth plates—and the function of the "secondary jaws." Are we to suppose that the circumgastric ring of ten *radially situated* pieces (our first epineurals) rested against or over the borders of the stomach and served for "internal massage" or for a compress to aid in the emptying of the stomach cavity? Was the ring of ten double-headed internal "crushers of the oesophagus" an essential adjunct of this new and wonderful mechanism? Those against an oral aspect must explain this apparently senseless arrangement of heretofore wholly unknown plates. Should further study establish their view we may properly expect that the biological story told by these plates will be one of intense interest.

THE ABORAL SKELETON.

The balance of Dr. Raymond's evidence is contained in the paragraph commencing on p. 106, line 44, of his criticism and is derived from the plates marked (x) and (y) in our plate VIII, fig. 1. I agree with him that for these "a place cannot be found in the structure of the specimen" (p. 106, lines 45-46). He finds, however, that "they are not far from their original position" (p. 107, lines 18-19). That they were thrust to their present position after the burial of the specimen is made manifest, not only by the plates in the immediate vicinity, but plates now lost must have communicated this thrust to interradius 1, and there not only turned the secondary jaws, but displaced one of the mouth plates and the oral. Dr. Raymond's assertion that "if these were plates foreign to this specimen, they would not maintain their natural position in relation to each other, but would be separated," is evidently meant to indicate that the overriding movement was not of great magnitude. He must have frequently found forms buried serially over each other, without necessarily finding all the plates of the upper specimens "separated." An examination of our plate VIII, fig. 1, with a stereoscope leads me to doubt if (y) belongs to (x) any more than (z) does. I find plate (y) depressed; the meeting faces neither parallel nor of the same form; and if the plate really belonged to (x) shifted a little toward radius I, though I should have expected the thrust to have made it slip in an opposite direction. The movement instead of *separating* these plates has thrust them together. Dr. Raymond asserts that (y) cannot be an adambulacral of another specimen (p. 107, lines 12-14) because it "is larger and of different shape." It has two diameters perpendicular to its sides of about 0.8 mm each, which is a little less than the transverse diameter of the adambulacral just back of the undisturbed mouth plate in radius II. Turn this adambulacral on its side and you will have a plate displaying an area greater than that now shown by (y). Plate (x) "is pointed at the wider end" (p. 107, line 6), but I cannot be positive that the faces on each side of the angle are either true sutural faces or that this is the original orad end of the plate. The smaller face seems to possess the granular ornamentation of the aborad end of a marginal and the lines of blackened organic fragments buried in the plate run parallel to the long face while in the stereograms (photographs) these lines are distinctly subparallel with the sides next the first arm marginals. If plate (y) belonged to the aboral skeleton it is sheltered enough to have retained some ornamentation, but it is as smooth as a sutural face of an adambulacral. As all other plates have been completely weathered away we must credit the remaining big plate with a serious loss of its original surface. I would not like to assert of this plate, which shows rotation on both its long and short axes in addition to great loss of surface, that it has the "same form" (p. 107, line 19-21) as an interradial superomarginal of Palæaster matutina, Hall.

XII. Mr. Narraway's very kind second loan of the type has enabled me to make a number of stereograms of it, and since returning the specimen to him, I have found three among them that offer more important evidence concerning the nature of the aboral skeleton than I had before noted. In plate VIII, fig. 1, the present floor of the oral cavity shows a number of very small ossicles having diameters of between 0.10 and 0.15 mm. These are most clearly seen around the inner margin of the "torus," in interradius 1. To the right of the whiter of these ossicles there are a number of darker molds or thinly covered ossicles having similar diameters and an alternate arrangement. The half tone process will hardly allow these to be seen, but in plate IX, fig. 2, thin, angled plates with a diameter of 0.2 mm should be visible on the dark background of the upper part of the figure. A transverse row of three of these will be found just above the last adambulacral and marginal at the right. There is also one quite clearly revealed two centimeters (measured on the stereogram) above the right-hand marginal and on a line with its inner face. These plates are very regularly arranged and each has a small central projection about 0.03 mm in diameter. Twenty-five or more of these plates can be recognized in the photographs from which this figure is produced. There is a median row of slightly larger plates, and on each side of this at least five other rows arranged in regular alternation. A number of the same plates may also be seen near the end of ray IV. As P. narrawayi can hardly have had its oral skeleton sandwiched between two aboral skeletons, I think this case does not need further argument.

Dr. Raymond in his criticism has kindly sought to share a responsibility for my errors and to make Mr. Narraway assist him in this, by frequently using the pronouns "we" and "our" to represent an offending trio who persisted in their error even though (p. 105, line 24) "it must be confessed, all dissented from our view." This use of these pronouns is misleading. Dr. Raymond had a manuscript copy of my paper before its publication and duplicates of some of my photomicrographs. My experience with "paleontologists and students of recent echinoderms" was not as he unwittingly represents it. On p. 106, lines 28-32, he states: "The chief reason that Narraway, Hudson and myself had for thinking that *Protopalæaster narrawayi* was exposed from the actinal side was that the covering pieces did not look like ambulacral plates, * * * *". Here again I believe the statement would have gained in accuracy had the first two names been omitted. It must be evident at least that Dr. Raymond did not know my reasons. To Mr. Narraway is due the credit of recognizing the true character of the "covering pieces." Aside from agreeing with him in this, my study of his specimen was wholly my own, and neither he nor Dr. Raymond are in any manner responsible for errors in my paper.

REFERENCES.

A. A fossil starfish with ambulacral covering plates. By George H. Hudson, OTTAWA NATURALIST, Vol. XXVI, p. 21-26, 45-52 (May, June-July, 1912).

B. On the nature of the so-called "Covering plates," in Protopalæaster narrawayi. By Percy E. Raymond, OTTAWA NATURALIST, Vol. XXVI, p. 105-108, Plate VI (December, 1912).

C. The use of the Stereogram in Paleobiology. By George H. Hudson, New York State Museum Bulletin, 164, p. 103 to 130, plates I-XIII; Annual Report of the Director of the Science Division for 1912.

EXCURSIONS.

BILLINGS' BRIDGE, Sept. 20, 1913.—A most delightful fall excursion of the Club was held near Billings' Bridge on the above date. About 25 members were in attendance. The chief object of the excursion was to study the aquatic plants which grow in such profusion near the Islands, a short distance from Bank Street. A sufficient number of boats had been arranged for, and under the guidance of Miss F. Fyles, Assistant Botanist of the Experimental Farm, observations were made and collections gathered of many of the water plants of the vicinity.

In midsummer the beauty of our Canadian water gardens is so apparent as to attract the attention of even the unobservant: masses of waxen arrowheads, gayly bright-blue pickerel weed and water lilies, yellow, pink and white, bladderworts, or yellow sunbonnets and water arums all in flower at once. But, in the autumn, when the flowers have shed their bright petals, the interest is in the fruiting heads of the reeds and rushes and in the less conspicuous submerged plants; of the latter class, the water-weed (*Elodea canadensis*), which becomes a great pest in shallow canals, almost completely filling the passage with its dense growth. Belonging to the same family is the ribbon grass

(*Vallisneria spiralis*). This plant, which might better be called water ribbon, as it does not belong to the grass family, was still blooming. Some of the white pollen of the staminate flowers was seen on the surface of the water floating to meet the pistillate flowers, which had arisen with sudden growth to receive it. Several species of the pondweed were found, one of the most abundant being the clasping-leaved pondweed (*Potamogeton perfoliatus*), and entangled with these was the mud plantain (*Heteranthera dubia*), which earlier in the season raises its pale yellow flowers just above the water; and in the same company, the hornwort (*Ceratophyllum demersum*) and water milfoil (*Myriophyllum* sp.). These two last-named plants somewhat resemble one another in general appearance, but on closer examination we find a readily remembered distinction in the feather-like leaves of the latter. Closer to the shore, where the Cat-tails (*Typha latifola*) and the Wild Rice (*Zizania* sp.) are always in evidence, were seen the artistic globular heads of the bur-reeds (*Sparganium eurycarpum* and *S. americanum* var. *androcladum*) with many members of the Sedge family, chiefly the club-rush (*Scirpus validus*), nut-grass (*Cyperus esculentus*), the dark green bulrush (*Scirpus atrovirens*), and the *Dulichium arundinaceum*. Floating among the stalks of these plants was the vivid green of the little duck-weed (*Lemna minor*), and the greater duck-weed (*Spirodela polyrhiza*) and the large lily pads. The different species of water lilies were distinguished, apart from the shape of the leaves, which is rather uncertain, by the seed vessels. The fruit of the yellow pond lily (*Nymphaea* sp.) remains above the water to ripen its seeds, while the pink and white water lilies (*Castalia* sp.) complete their maturity beneath the surface. On the edge of the shore, as a graceful background to the straight lines of the reeds and rushes, the trees were noticed to be festooned with the orange-berried bitter-sweet (*Celastrus scandens*) and the rich, blue, grape-like clusters of the Moonseed (*Menispermum canadense*) and bending over into the water, the long, red-leaved stems of the water-willow (*Decodon verticillatus*).

Several of the members proceeded direct to one of the islands to examine land plants and collect insects, and other zoological specimens. Unfortunately, however, the collections made were small. At 4.30 the whole party met on the Island and short addresses were given by several of the leaders. Miss Fyles spoke of many of the plants which are mentioned above, and answered questions regarding them.

Mr. H. McGillivray referred to the geological formation of the district, it being of the Utica rock formation. A specimen of a fresh water shell of the genus *Unio*, collected on the Island, was discussed, and the statement made that a large number of specimens of rocks and shells secured in the Ottawa district had been collected during the summer. These he hoped to exhibit to members of the Club at a later date.

Mr. J. R. Dymond, of the Seed Branch, Department of Agriculture, discussed many of the plants which had been found growing on the Island. A number of species were shown and identified. None of these were of uncommon occurrence, but their names were asked for by some of the members present.

The common leopard frog, which frequents the damp places of the Island, was shown by Mr. Andrew Halkett, and remarks made upon its life-history. A tadpole of another species of frog was also shown, and explanations given as to how the gill apertures become closed as the frog assumes its lung-breathing function, and how the paired limbs develop. Specimens of land-mollusks, viz.: juveniles of a helicoid, snails with their shells of the genus *Succinea*, and two small shells of a gastropod, requiring determination, were exhibited.

Mr. F. W. L. Sladen, Assistant Entomologist for Apiculture at the Experimental Farm, showed some males of *Vespa diabolica* captured at raspberry flowers, in which the markings varied. He called attention to the neglected field of the study of wasps and wild bees, viz.: the superfamilies, *Vespoidea*, *Sphecoidea* and *Apoidea*. During the past season he had taken two or three thousand specimens of these in the Ottawa district, consisting of over 300 different species, not a few of which are probably new to science.

Mr. Arthur Gibson, First Vice-President of the Club, who had charge of the excursion, spoke in conclusion on certain insects which were noted, mentioning particularly the Burdock Gelechiid (*Metzneria lapella*), the larvæ of which are so useful in destroying the seeds of burdocks and which hibernate in the heads, and the galls of *Pontania pomum*, known as the Willow Apple Gall, which had been found abundantly on the leaves of *Salix discolor*. Freshly emerged specimens of the beautiful large dragon fly, *Anax junius*, were also shown.

EXPERIMENTAL FARM, September 27th, 1913.—Thirty members of the Club met at the end of the car line at 3 o'clock. A visit was first made to the memorial erected to the memory of the late Dr. James Fletcher, one of the founders of the Club. The party then, under the guidance of Mr. Arthur Gibson, First Vice-President, and Mr. F. E. Buck, of the Horticultural Division, examined the climbing vines on certain of the Farm buildings, the remarkable collection of hedges, undoubtedly one of the best to be found anywhere, and afterwards many of the groups of trees and shrubs in the arboretum. The flowering plants were later visited and information given as to those most worthy of cultivation. The Insectary of the Division of Entomology was shown, and the method of studying the life-histories of destructive insects described.

BEAVER MEADOW.—The last of the fall excursions for 1913 was held on the afternoon of October 4th to the Beaver Meadow, near Hull. Since the previous excursion to Beaver Meadow, the lower end of this locality has changed considerably owing to ts having been divided into building lots, on which already a fair sprinkling of homes have been established. The beautiful wood to the right of the stream, on entering the meadow, is a "thing of the past," but fortunately, as yet, from the naturalists' point of view, the upper end is unchanged, and it is sincerely hoped that this may be left as it is for very many years. The locality has always been a favourite haunt of the Club, and many happy hours have there been spent by its members.

After wandering about for nearly two hours, the party reassembled and listened to brief remarks by leaders present. Mr. Andrew Halkett spoke of batrachians which had been collected, viz.: the Leopard Frog, the Wood Frog and the Common Toad. A fine specimen of the Garter Snake was shown and remarks made on snakes in general and their habits.

Mr. Arthur Gibson spoke on certain insects and showed specimens of the large Water-strider, which skates over the surface of the stream; the Hedge-hog Caterpillar, which was crawling about in search of a convenient place to hibernate; and the Lesser Migratory Locust, which this year has been very destructive near Ottawa in fields of barley, oats, potatoes and corn.

Mr. E. C. Wight showed specimens of Meadow Rue, Joe-Pie Weed, Butternuts, etc., confining his remarks chiefly to their medicinal properties. He also referred to several bad weeds, particularly the Blueweed, aften called Blue Devil, which is so common in Ontario and the eastern provinces and which is much enquired about by farmers.

Mr. H. McGillivray exhibited specimens of rocks and shells which he had found in the district. A most interesting specimen was a nodule on which there was the impression of a petrified capelin, a specimen of fish which is yet extant.

THE JUBILEE MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

One of the most important gatherings of entomologists which has ever taken place in Canada was that which met at the Ontario Agricultural College, Guelph, on August 26th, 27th and 28th, 1913, to celebrate the Jubilee Meeting of the Entomological Society of Ontario. Among the distinguished entomologists from outside of Canada who were in attendance were: Professor J. H. and Mrs. Comstock, of Cornell University, Ithaca, N.Y.; Dr. E. P. Felt, Albany, N.Y.; Prof. T. J. Headlee, New Brunswick, N.J.; Prof. P. J. Parrott, Geneva, N.Y.; Dr. A. D. MacGillivray, Urbana, Ill.; Dr. R. Stewart MacDougall, Edinburgh, Scotland; Mr. Geoffrey Meade-Waldo, London, England; Prof. F. M. Webster, Washington, D.C., and Dr. W. M. Wheeler, Boston, Mass. The following entomologists from Canada were present: Rev. Prof. C. J. S. Bethune, Guelph, Ont.; Rev. Dr. T. W. Fyles, Ottawa; Mr. H. H. Lyman, Montreal; Prof. W. Lochhead, Macdonald College, Que.; Dr. C. Gordon Hewitt, Messrs. Arthur Gibson, F. W. L. Sladen, Ottawa; Dr. E. M. Walker, Dr. A. Cosens, Mr. J. B. Williams, Toronto; Prof. T. D. Jarvis, Messrs. L. Caesar, A. W. Baker, G. J. Spencer, Guelph; Prof. John Dearness, W. E. Saunders, London, Ont.; John D. Evans, Trenton, Ont.; F. J. A. Morris, Peterboro, Ont.; R. S. Hamilton, Galt, Ont.; R. C. Treherne, Agassiz, B.C.; J. D. Tothill, L. S. McLaine, Fredericton, N.B.; G. E. Sanders, Bridgetown, N.S.; C. E. Petch, Covey Hill, Que.; J. C. Chapais, St. Denis (En bas), Que.; W. A. Ross, Vineland Station, Ont.; H. F. Hudson, Strathroy, Ont.

In the afternoon of August 27th, President Creelman, of the Ontario Agricultural College, welcomed the entomologists to the College and in a bright, happy speech, spoke of the value of the practical side of the study of insects to the agriculturist and the community at large. Addresses to the Society on its having attained fifty years of service were presented by delegates, representing a large number of Universities, Colleges of Agriculture, Societies, etc., the world over. Greetings from the Ottawa Field-Naturalists' Club were presented by Mr. Arthur Gibson.

During the two days' session at Guelph important papers were presented by Rev. Dr. Fyles, Rev. Dr. Bethune, Dr. A. D. MacGillivray, Dr. A. Cosens, Dr. R. Stewart MacDougall, Prof. F. M. Webster and Mr. F. J. A. Morris.

On the evening of August 27th the delegates and members were entertained by Dr. and Mrs. Creelman, and on the following evening Dr. W. M. Wheeler delivered a most delightful and instructive lecture on "Ants." This was illustrated by a collection of exceptionally good lantern slides. All of the papers, etc., presented at the meeting will be published in full in the Annual Report of the Society.

On August 29th the Society entertained the members and delegates to an excursion to the Grimsby district, where collections of insects were made and several orchards visited, which showed full well the value of spraying ,etc., to control injurious insects.

Dr. C. Gordon Hewitt, Dominion Entomologist, Ottawa, was elected President of the Society for 1913-1914. The City of Toronto was decided as the place of the next meeting.

POPULARITY AND ROLE OF THE ROSE.*

By F. E. BUCK, Experimental Farm, Ottawa.

The popularity of the rose is rapidly increasing. To such an extent is this true that quantities of beautiful roses belonging to the Hybrid Tea class are now being planted in sections of country where up till recently it was thought impossible to grow with safety roses of this class at all. For instance, several rose lovers in Canada have recently planted large quantities, of the best varieties that it was possible to import, of these roses. With slight winter protection many of them are apparently quite adapted to conditions of climate as far north as Montreal and Ottawa.

In connection with the spread of this flower, it may be apropos to ask why it is that it has always held the premier position amongst flowers?

In the spread of culture and the aesthetic spirit throughout the world the role which the rose has played has been an important one, and in this paper it is the intention to briefly discuss that role.

The fact that somewhere during every hour of every day and night the sun is shining somewhere in that vast empire called British is often emphasized. Another fact equally significant to us perhaps in another way is that that same sun every day of the 365 of every year calls into fragrance and beauty somewhere in that same vast empire blossoms of one of the most perfect of flowers, the rose. Although this statement may perhaps sound exaggerated, it is nevertheless true. Roses to-day are in bloom in some parts of the same country for about nine months out of every twelve of the year.

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*–Paper presented at meeting of O.F.N.C., Dec. 10,1912.

The wealth of bloom in some of the Rose Gardens of Europe is magnificent and the variety wonderful.

At the Central Experimental Farm, Ottawa, a new Rose Garden has been recently planted with the object of testing most of the best of these modern roses, for hardiness and suitability for Canadian conditions.

Is the popularity of the rose likely to go on increasing and to what cause or causes is its popularity to be ascribed? These are two questions similar to the one already asked and it is hoped that an answer will be at least suggested in what follows.

In the first place it may be mentioned that the esteem in which the rose is held is by no means of modern growth. The following account of the birth of the rose will show how the Ancients prized it:

"Of the birth of the rose, the queen of flowers, it is related in fable that Flora, having found the corpse of a favorite nymph, whose beauty of person was only surpassed by the purity of her heart and chastity of mind, resolved to raise a plant from the precious remains of this daughter of the Dryads, for which purpose she begged the assistance of Venus and the Graces, as well as all the deities that preside over gardens, to assist in the transformation of the nymph into a flower that was to be by them proclaimed queen of all the vegetable beauties. The ceremony was attended by all the Zephyrs, who cleared the atmosphere, in order that Apollo might bless the new created progeny with his beams. Bacchus supplied rivers of nectar to nourish it, and Vertumnus poured his choicest perfumes over the plant. When the metamorphosis was complete Pomona strewed her fruit over the young branches which were then crowned by Flora with a diadem that had been purposely prepared by the Celestials to distinguish this Empress of flowers."

This fable suggests the place which the wild or native roses held in the world of floriculture. The modern rose, with the co-operation of man, is a much more perfect creation than the rose alluded to in the foregoing, and through it nature has called into exercise the highest qualities of mankind. For this reason the rose has played and is still playing a role which is immensely potent in influencing the ethical history of the human race.

The role which each great man plays in life does not always influence the race for good. The role played by the Emperor Nero can scarcely be said to have influenced the world for good, and even that played by such as Napoleon is questionable. Indeed the role played by most men and women affects hardly at all the destinies of the race; but the role played by the rose, if we may consider the good influences exerted by it, in this way, has always been beneficent or interesting, and to such an extent is this true that it is quite easy to divide this influence into various phases.

One of the very pleasing minor duties of the rose has been to hand on to us, as it were, a little series of biographical or historical notes on those personages who have had their names immortalized through association with the "queen of flowers." One instance will be sufficient perhaps to indicate what is meant. It may be best given in the form of a story of one of the most prized of the older roses; it is a dainty story of a notable rose from France. "When Niel, a brave French general, was returning from the scene of his victories in the war between France and Austria, he received from a peasant, who wished to honor the hero, a basket of beautiful pale yellow roses. One of the stems, which happened to have a root clinging to it, the general took to a florist in Paris, in whose care it remained until it became a thriving bush covered with blossoms. Niel then took the plant as a gift to the Empress Eugenie. She expressed great admiration for the exquisite flowers and on learning that the rose was nameless said significantly "Then I will name it. It shall be 'The Marechal Niel' and at the same moment she bestowed upon the astonished general the jeweled baton that betokened his promotion to the high office of Marechal of France."

Lord Penzance, who has given us some beautiful brier roses, will be remembered as a great lawyer, but much as law may do to carry his name down the pages of history, his rose creations will do much more. William Allen Richardson is an unknown entity, but known in literature because his name became that of a rose, and Dorothy Perkins, Mrs. John Laing, and many others are names which will be household words for many years at least because their possessors loved the rose.

The only other minor role of the rose which we shall mention is one which is of greater interest to those interested in it from the botanical and historical standpoints than it is to the average grower. Botanists well know that the rose is native only to the temperate parts of this world; they also know that we have about nine species native to this country. The genus Rosa is not large, Gray mentions only fifteen species. Great Britain and Denmark claim about twenty species. The interesting part about these native species is that in working with them the hybridist found that they responded in a remarkable way to cross-fertilization. Until the year 1867 new roses other than the original species were few in number and mostly plants of chance. When, however, about that date a Mr. Bennett, in

England, and other men in France, began some pioneer work in cross-fertilization of roses, a new era began in the world of floriculture, and the role which the rose has played in the efficient development and understanding of the art of plant improvement is only realized when we compare a modern plant catalogue, and especially a rose catalogue, with one printed less than fifty years ago, and then, few, we suppose, really grasp the meaning of the difference in such lists.

But let these few last words be for the consideration of the real role of the rose. One has said "What muse has been able or language sufficient, to do justice to a plant that has been denominated the Daughter of Heaven, the Glory of the Spring, and the Ornament of the Earth. . . . To paint this universal emblem of delicate splendor in its own hues, the pencil should be dipped in the tints of Aurora when arising amidst her aerial glory. Human art can neither colour nor describe so fair a flower. Venus herself finds a rival in the rose, whose beauty is composed of all that is exquisite and graceful." And it may be justly concluded that to possess such a flower and to grow it for its fragrance and beauty has been a potent desire which has led to the creation of many of those beautiful gardens not only around the "Stately Homes of England," but in ever increasing number on this continent also, and standing in one of these gardens and beholding the roses, or sitting in the doorway of one of the humblest cottages of the land, and scenting the fragrance of roses climbing around tiny windows, can any being revel in gross selfishness or remain unconscious to the fact that such flowers would win him to magnanimous conduct and invite him to be their messengers to carry fragrance and cheer to the sick and afflicted of mankind? And is there a man who can sell himself to pure utilitarianism when around him are examples of a type of beauty which has won multitudes of mankind to taste through the joys of the aesthetic life the real fulness of living? And surely none can be mere animal only in passions when forms so perfect in symmetry and shape appeal to him to witness their perfect modesty and grace?

The rose, Queen of Flowers, has a true role in this world, and that role no mortal may dare make light of. To take chief part in shaping the aesthetic taste in man, to encourage the love of the garden, the love of fragrance, of beauty of form, of exquisite color is a task of no mean order, and yet the modern rose is encouraging, more than ever before, a more clamorous appetite, a truer aesthetic thirst for these things, a true indication, surely, that her supremacy is secure and her role a beneficient one.

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THE HAUNTS OF SOME OF OUR NATIVE FERNS.

By A. Cosens, M.A., Ph.D., Toronto.

A plant is dependent on its surroundings for the raw materials of the food necessary for its nutrition, also the energy required to manufacture this food is supplied from agents that are without the body of the plant. Even the important functions of pollination and seed dispersal are left very largely to the care of external forces.

A consideration of these facts leads us to see that each plant has definite and vital relations to the various components of its environment. These life relations are often so numerous and complicated as to be only partially understood. As the component factors of any environment are never stable for any considerable length of time, the welfare of the individual plant is dependent on the fact that it exhibits a certain degree of plasticity in relation to its surroundings. If a plant is to exist it cannot present an unyielding front to the forces surrounding it. A certain structure is transmitted to a plant by its ancestors; an ever changing environment tends to vary this transmitted form. This feature of plant life is of such universal application that we may consider a pathological condition as a variation from the normal to such an extent that the life of the plant is endangered.

The study of the habitats of our native ferns presents several points of interest and opens up many avenues for investigation. As a rule these plants do not exhibit plasticity of structure to nearly the same extent as our ordinary flowering plants. As a consequence of this the conditions under which the various ferns can flourish are much more restricted.

The chief factors of the environment of these plants, arranged in the order of their importance, are: light, water, drainage, soil; of less importance are heat and wind. Their relations to other plants will be considered in connection with light, as many of the plants with which they are associated have important shade producing qualities.

In some cases a fern is so restricted in distribution that it is a matter of little difficulty to decide upon its natural habitat. In others, certain species are found in various locations presenting different conditions, and a comparison has to be made of plants and stations before a conclusion can be arrived at. As a general rule, a fern of normal size, of a healthy color and spore producing is growing in its natural location.

The conclusions of the writer are based on investigations made chiefly in the counties of York, Peel, Waterloo, Huron, Grey and Bruce.

PTERIS AQUILINA L. (Common Brake or Bracken). Is so widely distributed that we may say it is found almost throughout this hemisphere. In some localities the specimens are gigantic in comparison with ours. In Oregon it attains a height of six to seven feet; in the Andes of fourteen feet. It is found also in Great Britain. In the Journal of the Linnaean Society, Boodle gives its height in England as seven to eight feet. Its occurence in the Highlands of Scotland is evident, as Sir Walter Scott mentions it several times in "The Lady of the Lake":

"From shingles gray their lances start,
The bracken brush sends forth the dart."

……

"Each warrior vanished where he stood,
In broom or bracken, heath or wood."

……

"The next all unreflected shone
On bracken green or cold gray stone."

A plant of such wide distribution must be capable of an extended range of variation without endangering its life processes. But as it often occurs in large patches extending over localities that introduce different ecological factors, a conclusion can be arrived at with a fair amount of confidence by a comparison of specimens from different parts of the station.

The preferred habitat of *Pteris* is the top or slope of a dry hill covered with sandy loam. The shade producing plants almost invariably present are poplars, paper birch, sumach, pin cherry and hemlock. It is found near Credit Forks on sandstone strata covered by only a few inches of loam; in this locality it is associated with *Aspidium spinulosum* and shaded chiefly by pin cherry and paper birch. On passing in from the face of the cliff the loam becomes of greater depth and the timber consequently larger and of greater variety. The additional shade producing plants are hard and soft maple and beech. This shade dwarfs the *Pteris* in spite of the increased depth of loam.

In the denser shaded stations the fern was in company with *Asplenium Filix-femina* and *Cystopteris fragilis.*

Before proceeding to a consideration of the cliff ferns, it will be necessary to give a short description of a station already mentioned, namely, Credit Forks. This location is situated in the northern part of Peel County; there the Credit River has cut through the Niagara escarpment, leaving an exposure of clay and rock of about 345 feet in height. Commencing below the level of the Credit River a slope of red clay extends upward for 175 feet; overlying this is about 20 feet of Medina sandstone, while the top of the section furnishes an outcrop of 150 feet of almost vertical limestone of the Niagara formation. The clay clope is covered with a talus of blocks of sandstone and limestone fallen from the cliff above, and in the crevices of these rocks many ferns find roothold.

CRYPTOGRAMMA STELLERI (Gmel.) Prantl. (Slender Cliff Brake). Found usually on narrow, moist, shaded ledges of limestone cliffs. It roots, in company with moss, in detritus derived from the weathering of the rock. It is a frail and delicate species, very sensitive to sun and to lack of moisture.

PELLAEA ATROPURPUREA (L.) Link. (Purple Cliff Brake). In crevices of limestone cliffs; not nearly so sensitive to lack of shade and moisture as the former species. It is often found in dry situations under full illumination. It thus shows closer affinities with *Pteris.*

The two cliff brakes we have just considered are both found in the vertical limestone section of the Credit Forks' escarpment. It is worthy of note that they are entirely absent from the blocks of rock which cover the clay slope.

SCOLOPENDRIUM VULGARE Sm. (Hart's Tongue). This fern is found abundantly in Europe; in England it is reported as hanging from old ruins and even drooping from the stone curbs of wells. In America, however, it is exceedingly rare; it is found in Tennessee and New York, while in Ontario it is confined to the district between Collingwood and Owen Sound. At Woodford, near Owen Sound, it is found rooting in soil on the top of limestone rocks and cliffs; there it is associated with *Polystichum Lonchitis* and *Polypodium vulgare.* The ferns are shaded by paper birch, small maple and beech, with an occasional hemlock. It grows at Owen Sound from crevices in the walls of fissures in limestone rocks; but under these conditions, however, it does not thrive as well.

POLYSTICHUM LONCHITIS (L.) Roth. (Holly Fern). Has nearly the same distribution in Ontario as *Scolopendrium* and its habitat is practically the same.

POLYPODIUM VULGARE L. (Common Polypody). Found on the tops and upper ledges of rocks where the soil is well drained; the usual shade-producing plants associated with it in this habitat are poplar, paper birch, small hard maple and hemlock. Also found rarely on clay banks where the soil contained a little sand; in this habitat it was practically unshaded as the slopes were typical hemlock ridges. The plants under the latter conditions were dwarfed, probably from lack of shade rather than from the nature of the soil.

CAMPTOSORUS RHIZOPHYLLUS (L.) Link. (Walking Fern). Is found usually in crevices in limestone and sandstone rocks, but sometimes rooting in moss on narrow ledges. Appears to prefer the shady side of the rocks, but thrives fairly well in the sun. It is found in abundance on the rocks that cover the clay slope at Credit Forks.

ASPLENIUM TRICHOMANES L. (Maidenhair Spleenwort), and ASPLENIUM VIRIDE Huds. (Green Spleenwort) are found rooting in the crevices of shady rocks and cliffs; usually limestone or sandstone. They are not sensitive to lack of moisture, but *A. viride* does not stand exposure to the sun so well as the other species. Both the ferns are associated at Credit Forks among the talus on the clay slope.

ASPIDIUM THELYPTERIS (L.) Sw. (Marsh Fern). The ideal habitat of this fern is decidedly wet, as it is found growing usually with cat-tails. Shade is not an indispensable factor, but the fern is sheltered when thriving best. The shade producers are commonly cedar, black ash, soft elm, hemlock and occasionally basswood. In moist situations, under full illumination, the fern thrives and it will grow in a fairly dry situation until crowded out by grasses and sedges. It shows a high degree of plasticity in relation to the environment, more so than any of our native ferns, unless perhaps *Pteris*.

ASPIDIUM NOVEBORACENSE (L.) Sw. (New York Fern). In direct contrast to the preceding species, this fern is found in dry soil, but always under dense shade in the typical "cool woods." It is very abundant in a woods near Lake Huron; there it is associated with partridge berry, pyrolas, and shaded by birch, hemlock and maple. Maple and beech underbrush were also important factors in shade production. As only a few inches of humus was covering a somewhat impervious substratum of sandy loam, sufficient moisture was ensured. The rootstocks of the ferns did not penetrate below the humus. In mucky parts of the same woods *Polystichum acrostichoides* and *Adiantum pedatum* were associated with this fern.

Aspidium spinulosum var. intermedium (Muhl.) D. C. Eaton (Spinulose Wood Fern), and Aspidium marginale (L.) Sw. (Evergreen Wood Fern). Both of these ferns thrive well in a moist, typical "cedar swamp," with a mucky soil. They are usually shaded in such a habitat by cedar, hemlock, black ash and mountain maple. The latter species is impatient of too dense shade and will thrive in a fairly open situation. The former will also stand exposure, but as a rule thrives better if the shade is fairly dense. The glandular character of the indusium of this fern varies with the environment. These ferns also thrive well in clay loam, especially on the face of slopes. In this location they are shaded by hard maple, beech and ironwood, with cedars and an occasional hemlock.

Aspidium cristatum (L.) Sw. (Crested Shield Fern). This fern prefers a mucky soil; its locations overlap those of *Aspidium Thelypteris* and *Onoclea*. Trees peculiar to such a situation, such as ash, cedar and mountain maple furnish the necessary shade. In comparison with its associates, however, it appears always to select a somewhat higher station and is found growing on logs and around stumps. It stands exposure fairly well; this may be due to the fact that the sun exercises a directive influence on the position of the pinnae.

Polystichum acrostichoides (Michx.) Schott. (Christmas Fern), and Adiantum pedatum L. (Maidenhair). These ferns are both very sensitive to exposure and are found only where the shade is very dense. Their habitat seldom overlaps with *Aspidium spinulosum* and *A. marginale* in their cedar swamp location, but often does in the hardwood station. Thus on a slope where the humus overlies a clay loam the four ferns may often be found. A dense shade is produced in a typical location by maple and beech, while an occasional hemlock and basswood may also be present. In such a habitat, *P. acrostichoides* will almost invariably be found towards the top of the slope, while *A. pedatum* selects the rather more moist and sheltered location at the foot.

Asplenium Filix-femina (L.) Bernh, (Lady Fern). This fern is found at its best when growing at the edge of a mucky soil location. Under these circumstances it will be shaded by cedars and hemlocks, but trees peculiar to the transition zone, such as birch, soft elm and basswood, will also be found. It stands exposure to the sun very well. Sometimes it is found associated with *Aspidium cristatum*, but, in general, it prefers a habitat that is wetter.

Asplenium angustifolium Michx. (Narrow-leaved Spleenwort). In a station examined in Peel County this fern was growing in a shaded ravine through which water flowed in the spring. It was rooted in clay loam and shaded densely by beech and maple. It was associated with *Adiantum* and *Aspidium spinulosum* var. *intermedium*. In Huron County the fern was found in abundance in rather mucky soil at the bottom of a ravine, which served as a water course during a part of the year. A dense shade was given by maple and beech, with an occasional hemlock. The ferns associated with it were those mentioned above and *Polystichum acrostichoides*. With the exception of the soil, the two stations are identical. The fact of the water course underlying the habitat in each case is important in the facilities it gives for drainage.

ASPLENIUM ACROSTICHOIDES Sw. (Silvery Spleenwort). This fern requires a mucky, springy situation, but dense shade does not appear to be a necessity. The fern is found associated with *Impatiens* and fraternizing with *Onoclea Struthiopteris* and *Cystopteris bulbifera*. The station has usually scattered trees of beech, maple, ash and birch.

PHEGOPTERIS DRYOPTERIS (L.) Fee. (Oak Fern). The favorite habitat of this fern is at the edge of mucky soil, especially where it is shaded by maple and beech. It is found growing, also, in cedar swamps, on knolls, in mucky soil. Shade in this case is produced by pines and cedars. In this station the fern is sometimes associated with *A. marginale*. This fern is able to do well under decidedly dry conditions if it is not exposed to the sun. Growing in the open it becomes invariably infested with a blight that shrivels the fronds.

PHEGOPTERIS POLYPODIOIDES Fée. (Long Beech Fern). In most cases this fern and the preceding are associated, but the Beech Fern is much more sensitive to lack of moisture and requires shade that is extremely dense. A typical locality noted was one in which the fern was found growing in a slightly mucky, reddish clay loam, where the soil was overlying a sandstone stratum and was of little depth. The timber, in consequence of this lack of soil, was small, but so close together as to produce a very dense shade. Shade producing plants present were beech, maple and hemlock, but occasionally also birch and basswood. The location described is situated at Inglewood, in Peel County, about three miles south of Credit Forks. The same escarpment is found there as at the Forks, but the overlying limestone is absent.

DICKSONIA PUNCTILOBULA (Mich.) Gray. (Hay-scented Fern). This fern was found in the same locality as the preceding but the soil, while slightly mucky, was less so than in the habitat of that species.

ONOCLEA STRUTHIOPTERIS (L.) Hoffm. (Ostrich Fern), and ONOCLEA SENSIBILIS L. (Sensitive Fern). The well known Ostrich and Sensitive Ferns are almost invariably found together, and it seems impossible to differentiate between their habitats. Their typical station is a moist clay or sandy loam in a locality that is overflowed by spring freshets. Shade is not an important factor if other conditions are favorable. The most luxuriant growth of these ferns that the writer has found was in Huron County. Here they were shaded by only a few straggling willows. The ferns were associated with Virginia creeper, Impatiens, wood nettle and turtle head. A spring creek nearby would overflow the station in flood time. In "Ferns and their haunts" W. N. Clute gives *O. Struthiopteris* as, "at its best in the wet, sandy soil of a half-shaded island or river shore."

WOODWARDIA VIRGINICA (L.) Sm. (Chain Fern), and OSMUNDA CINNAMOMEA L. (Cinnamon Fern). May be considered the peat bog ferns. *Woodwardia* is found growing in sphagnum moss and extending out nearly to the edge of the lake that often occupies the centre of the bog. It is associated with pitcher plants and orchids, such as *Calopogon*, and only slightly shaded by *Ledum*, *Kalmia* and *Cassandra*, with an occasional small black spruce. In fact, shade is almost a negative factor.

In a typical location examined the *Osmunda* formed an outer zone in immediate contact with the preceding fern. Its location, however, was drier and better shaded than that of *Woodwardia*. The shade producing plants were hemlock, larger black spruce and tamarack. *Ledum*; *Cassandra* and *Kalmia* were also present, but these were not thriving as well as in the inner zone. Occasional specimens of this fern are found also in the moist, mucky soil of cedar swamps, but locations that furnish peaty materials seem to be its natural habitat.

CYSTOPTERIS BULBIFERA (L.) Bernh. (Bulblet Bladder Fern), and CYSTOPTERIS FRAGILIS (L.) Bernh. (Fragile Bladder Fern) have well differentiated habitats. *C. bulbifera* is sharply marked out by the fact that spring water is an essential component of its environment. As long as this factor is present, others are not so important. As a consequence, it is found on dripping rock ledges or springy clay in cedar swamps bordering spring creeks, and in other habitats which present springy conditions of soil. Drainage is here a very important factor, as stagnant water does not present the proper conditions. *Aspidium Thelypteris* and *Onoclea* are not nearly so sensitive in this respect. One typical station examined presented the fern associated with Indian turnip and enchanter's nightshade near the base of a ridge with a decidedly springy soil. Another station selected by this fern is a mucky, springy soil, shaded by hemlocks and cedars, with an occasional mountain maple. In this same locality the fern was found near the edge of a spring creek or on mossy logs overhanging the water. When growing under these conditions it is often the most convenient vegetation that can be found to line a trout basket. The bulblet loaded tips of this fern often approach so close to the water of the creek that it almost seems a legitimate conclusion that the running water is an important factor in the dispersion of these bulblets. At Credit Forks it grows along the base of the limestone cliff wherever springs issue.

C. fragilis is found associated with *C. bulbifera* along the base of springy clay banks and cliffs. It is found, also where that species will not grow, in crevices of shaded limestone and sandstone rocks, where spring water is not present. It does not stand exposure to the sun. It is found growing in mucky loam, shaded by cedars and basswood, often associated with *C. bulbifera*, if the station is springy. In this case it selects the drier locations around stumps and logs.

AN UNUSUAL COLOURED RUDBECKIA.

It is well known that plants are liable to produce progeny unlike the parents, in some striking particular, such as those with additional petals, odd shapes or variations in colour. A well known example of the latter is found in the brown-blotched *Lepachys*, which occasionally turns up among the yellow ones, and though a mere colour variety has been given the name *pulcherrima*. An homologous example, which I have not observed recorded, was discovered this summer near here and consists of a blotched form of *Rudbeckia hirta*, in which the rays had about a third of their basal portion rich brown, being in fact almost identical to the *Lepachys* in that respect. The plant consisted of seven heads, all alike, which I had marked with the idea of securing seeds, but being close to a roadway they were unfortunately destroyed before reaching maturity. Fortunately, however, the species is perennial, and so, if all goes well, will flower again next year.

NORMAN CRIDDLE, Treesbank, Man.

ON THE GENERA OF THE EODISCIDAE.

By PERCY E. RAYMOND.

It has long been known that the name *Microdiscus*, in common use for small trilobites of Lower and Middle Cambrian age, is untenable, the genus *Microdiscus* having been founded by Emmons on a young specimen of *Cryptolithus* (*Trinucleus*). The name *Eodiscus* was suggested in manuscript by Professor Hartt when he was describing the Middle Cambrian fossils found near St. John, New Brunswick, for Dawson's Acadian Geology, but on the advice of Billings, he replaced it by *Microdiscus* at the time of publication. This name was, however, mentioned in Walcott's paper on the fauna of the Middle Cambrian (1884), and in 1896 Matthew used the name for a section of the genus *Microdiscus*.[1] Recently the writer proposed to raise the section name *Eodiscus* to generic rank, replacing *Microdiscus*. The type suggested was *Microdiscus schucherti* Matthew, which was the first species listed by Matthew under his section *Eodiscus*.[2] It seems wise, however, not to apply the term *Eodiscus* in too broad a sense, but to use it in much the same way in which Matthew did.

In reviewing the various species which have been referred to *Microdiscus*, omitting the *M. quadricostatus* of Emmons, we find three distinct types of shields. The first and most common is that typified by *Eodiscus schucherti* or *E. punctatus*, in which the glabella and axial lobe of the pygidium are both definitely defined by the dorsal furrows, and the cheeks of the cephalon and the pleural lobes of the pygidium are smooth. A second type of shield is seen in forms like *Microdiscus lobatus* or *M. dawsoni*, where the dorsal furrows are strong on both shields, and the pygidium has well defined ribs on the pleural lobes. To a part of this second section Matthew gave the name *Dawsonia*, a name which had been used in manuscript by Hartt for his *Microdiscus dawsoni*, and which had appeared in print in the Second Edition of the Acadian Geology, though not used as a generic name. This section name of Matthew's would also be raised to generic rank were it not for the fact that the name is no longer available, having been applied by Nicholson in 1872 to certain bodies found associated with graptolites. I therefore propose *Goniodiscus* for this section, with *Agnostus lobatus* Hall as the type.

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[1] Amer. Geologist, 1896 , vol. 18, p. 29, and Trans. N.Y. Acad. Sci. vol. 15, p. 237, 1896.

[2] Ottawa Naturalist, 1913, vol. 26, p. 139.

The third group contains but a single species, the *Agnostus? nobilis* of Ford. This form differs from all other known Eodiscidae in lacking the dorsal furrows on both cephalon and pygidium, and has thus the appearance of an *Agnostus* of the *laevigati* group. A nearly complete specimen of this species was recently found at the Lower Cambrian exposure on Pearl Street, North Weymouth, Mass., by Mr. T. H. Clark, and the specimen is now in the Museum of Comparative Zoology at Harvard University. The species has previously been known only by the single specimen which served Ford as a type. That specimen was poorly preserved, and has been lost since its description, so that the rediscovery of the species is of considerable interest, and it adds a new species to the rather scanty fauna of the Paleozoic of Massachusetts. Mr. Clark's specimen shows nearly all the dorsal shield, though the head is displaced from the body, and a part of one side of the thorax is missing. The presence of three segments in the thorax shows conclusively that this species belongs to the Eodiscidae and not to the Agnostidae. Both cephalon and pygidium are nearly circular, both have a narrow flattened border, and this border on the cephalon shows the row of small tubercles so often seen in this family. Neither cephalon nor pygidium shows the dorsal furrows or other markings, though by holding the specimen at a certain angle it is possible to make out the outline of a wide median lobe on the pygidium. The specimen is 7.5 mm. long. Since the type of *Agnostus? nobilis* is lost, this specimen may now take its place, and it becomes the type of the third group of the Eodiscidae, to which the name *Weymouthia* may be applied.

FAMILY EODISCIDAE, RAYMOND.

Hypoparia of small size, cephalon and pygidium sub-equal, free cheeks absent from the dorsal side, thorax of three segments. Pygidium annulated or smooth. Lower and Middle Cambrian. Northern Europe and Eastern North America.

GENUS EODISCUS, MATTHEW.

Eodiscidae with short glabella, and long or blunt neck spine, pygidium with a long ringed axial lobe and smooth side lobes. Type, *Eodiscus schucherti*, Matthew. Lower and Middle Cambrian. Europe and North America.

GENUS GONIODISCUS, NOV.

Eodiscidae with long glabella, usually blunt neck spine, and pygidium with rings on the axial lobe and ribs on the pleural lobes. Type, *Microdiscus lobatus*, Hall. Lower and Middle Cambrian. England and Eastern North America.

GENUS WEYMOUTHIA, NOV.

Eodiscidae without dorsal furrows on cephalon or pygidium, both shields being smooth. Type, *Agnostus*? *nobilis*, Ford. Lower Cambrian. Eastern North America.

BIBLIOGRAPHY.

The writer will be very glad to receive additions and corrections to this bibliography.

GENUS EODISCUS.

E. belli-marginatus (Shaler and Foerste), Bull. Mus. Comp. Zool., 1888, 16, p. 35, pl. 2, fig. 9.—Walcott, 10th Ann. Rept. U. S. G. S., 1891, p. 630, pl. 81, figs. 2, 2a, b.—Grabau, Occ. Papers Bos. Soc. Nat. Hist., 1900, 4, p. 670.

E. belli-marginatus Mut. *insularis* Matthew, Trans. Roy. Soc. Can., 1899, ser. 2, vol. 5, sect. 4, p. 75, pl. 3, figs. 6a, b.

E. comleyensis (Cobbold). Quart. Jour. Geol. Soc., 1910, 66, p. 21, pl. 3, figs. 1-4.

E. connexus (Walcott). Am. Jour. Sci., 1887, 34, ser. 3, p. 194, pl. 1, figs. 4, 4b; 10th Ann. Rept. U. S. G. S., 1891, p. 631, pl. 80, figs. 9, 9a, b.—Matthew, Am. Geol. 1891, p. 287.,

E. eucentrus (Linnarsson). Sveriges Geologiska Undersokning, 1883, ser. C, No. 54, p. 30, pl. 4, figs. 19, 20. (Referred by Lake to *E. punctatus*, and by Groenwald to a variety of *E. scanius*).

E. helena (Walcott). Proc. U. S. Nat. Mus., 1889, 12, p. 41; 10th Ann. Rept. U. S. G. S., 1891, p. 632, pl. 81, figs. 1, 1a.—Cobbold, Quart. Jour. Geol. Soc. London, 1910, 66, p. 23, pl. 3, figs. 14-16. *E. cf. helena.* Burr. Am. Geol., 1900, 25, p. 47.—Grabau, Occ. Papers Bos. Soc. Nat. Hist., 1900, 4, p. 671, pl. 33, fig. 3.

E. meeki (Ford). Am. Jour. Sci., 1876, 11, ser. 3, p. 371.—Walcott, Bull. 30, U. S. G. S., 1886, p. 155, pl. 16, fig. 4; 10th Ann. Rept. U. S. G. S., 1891, p. 632, pl. 81, fig. 3.

E. praecursor (Matthew). Trans. N. Y. Acad. Sci., 1896, 15, p. 239, pl. 17, fig. 7. Non text fig.

E. pulchellus (Walcott). Bull 10, U. S. G. S., 1884, p. 24, pl. 2, figs. 1, 1a-c.—Matthew, Trans. N. Y. Acad. Sci., 1896, 15, p. 242, pl. 17, figs. 8a-f.

E. punctatus (Salter). Quart. Jour. Geol. Soc. London, 1864, 20, p. 237, pl. 13, fig. 11.—Matthew, Trans. N. Y. Acad. Sci., 1896, 15, p. 244.—Lake, Brit. Camb. Tril., 1907, p. 36, pl. 3, figs. 11-17.—Cobbold, Quart. Jour. Geol. Soc. London, 1913, 69, p. 37.

E. punctatus, non Salter. Whiteaves, Am. Jour. Sci., 1878, 16, ser. 3, p. 225.—Walcott, Bull. 10, U. S. G. S., 1884, p. 24, pl. 2, figs. 1, 1a-c.—Foerste, Bull. Den. Univ., 1888, 3, p. 117, pl. 13, fig. 5.—*E. pulchellus.*

E. punctatus praecursor (Matthew). Trans. Roy. Soc. Can., 1885, 3, sect. 4, p. 75, pl. 7, fig. 13.—*E. praecursor.*

E. punctatus pulchellus (Matthew). Trans. Roy. Soc. Can., 1885, 3, sect. 4, p. 74, pl. 7, figs. 12a-c.—*E. pulchellus.*

E. scanius (Linnarsson). Sveriges Geologiska Undersokning, 1883, ser. C, No. 54, p. 29, pl. 4, figs. 17, 18.—Groenwald, Bornholms Paradoxideslag, p. 79, 1902. (Referred by Lake to *E. punctatus*).

E. scanius eucentrus (Linnarsson). Groenwald, Bornholms Paradoxideslag, 1902, p. 79, pl. 1, fig. 20. (Referred by Lake to *E. punctatus*).

E. schucherti Matthew. Amer. Geol., 1896, 18, p. 30.—Trans. N. Y. Acad. Sci., 1896, 15, p. 238, pl. 17, figs. 4a-b.

E. speciosus (Ford). Am. Jour. Sci., 1873, 6, ser. 3, p. 137, figs. 2, a, b.; Ibidem, 1877, 13, p. 147.—Walcott, Bull. 30, U. S. G. S., 1886, p. 154, pl. 16, figs. 3a-c; 10th Ann. Rept. U. S. G. S., 1891, p. 632, pl. 81, figs. 5, 5a-c.—Matthew, Trans. N. Y. Acad. Sci., 1896, 15, p. 236, pl. 17, fig. 6.—Lake, Brit. Camb. Trilobites, 1907, p. 33, pl. 3, fig. 7.—Cobbold, Quart. Jour. Geol. Soc. London, 1910, 66, p. 23.

GENUS GONIODISCUS.

G. dawsoni (Hartt). Acadian Geology, 2d Ed. 1868, p. 654, p. 228.—Whiteaves, Am. Jour. Sci., 1878, 16, ser. 3, p. 225.—Walcott, Bull. 10, U. S. G. S., 1884, p. 23, pl. 2, figs. 3, 3a.—Matthew, Trans. Roy. Soc. Can., 1885, 3, sect. 4, p. 75, pl. 7, figs. 11a-c; Trans. N. Y. Acad. Sci., 1896, 15, p. 240, pl. 17, figs. 5a-e. (? 5a, 5b).

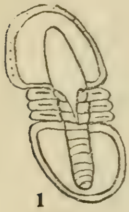
G. lobatus (Hall). *Agnostus lobatus* Hall. Pal. N. Y., 1847, 1, p. 258, pl. 67, figs. 5a-f.—Rogers, Geol. Penna., 1858, 2, p. 820, fig 614 (1-4).—*Microdiscus lobatus.* Ford, Am. Jour. Sci., 1873, 6, ser. 3, p. 135 footnote.—Walcott, Bull. 30, U. S. G. S., 1886, p. 156, pl. 16, figs. 1a, b; 10th Ann. Rept. U. S. G. S., 1891, p. 632, pl. 81, figs. 4a, b.—Shaler and Foerste, Bull. Mus. Comp. Zool., 1888, 16, p. 36, pl. 2, fig. 13.—Matthew, Amer. Geol., 1896, 18, p. 30.—Grabau, Occ. Papers Bos. Soc., 1900, 4, p. 671.—Lake, Mon. Brit. Camb. Tril., 1907, p. 32, pl. 3, figs. 4-6.—Cobbold, Quart. Jour. Geol. Soc. London, 1910, 66, p. 22, pl. 3, figs. 17, 18.

G. parkeri (Walcott). Bull. 30, U. S. G. S., 1886, p. 157, pl. 16, figs. 2, 2a; 10th Ann. Rept. U. S. G. S., 1891, p. 632, pl. 80, figs. 7, 7a.

G. sculptus (Hicks). Quart. Jour. Geol. Soc. London, 1871, 27, p. 400, pl. 16, figs. 9, 9a, 10, 10a.—Lake, Brit. Camb. Tril., 1907, p. 35, pl. 3, figs. 9, 10.

GENUS WEYMOUTHIA.

W. nobilis (Ford). *Agnostus? nobilis* Ford. Am. Jour. Sci., 1872, 3, ser. 3, p. 419, figs. 1, 2.—Walcott, Bull. 30, U. S. G. S., 1886, p. 150, pl. 16, fig. 7; 10th Ann. Rept. U. S. G. S., 1891, p. 629, pl. 80, fig. 7, 7a.—*Microdiscus*? *nobilis*. Vogdes, Am. Geol., 1892, 4, p. 383.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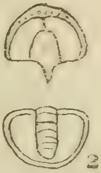
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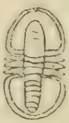
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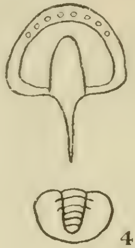
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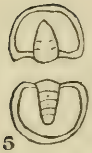
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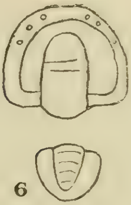
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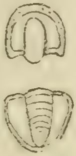
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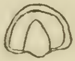
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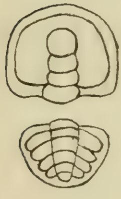
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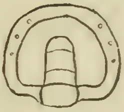
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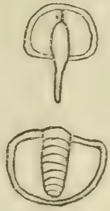
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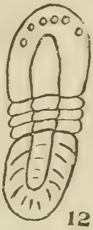
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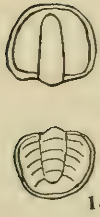
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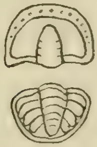
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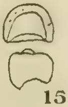
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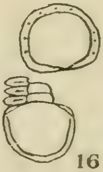
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EXPLANATION OF FIGURES.

1. *Eodiscus punctatus* (Salter). Middle Cambrian, Wales. After Lake.

2. *E. pulchellus* (Walcott). Middle Cambrian, New Brunswick. After Walcott.

3. *E. speciosus* (Ford). Lower Cambrian, Eastern New York. After Walcott.

4. *E. connexus* (Walcott). Lower Cambrian, Eastern New York. After Walcott.

5. *E. schucherti* (Matthew). Lower Cambrian, Eastern New York. After Matthew.

6. *E. helena* (Walcott). Lower Cambrian, Eastern New York. After Walcott.

7. *E. belli-marginatus* (Shaler and Foerste). Lower Cambrian, Eastern Massachusetts. After Walcott.

8. *E. präecursor* (Matthew). Middle Cambrian, New Brunswick. After Matthew.

9. *E. meeki* (Ford). Lower Cambrian, Eastern New York. After Walcott.

10. *E. scanius* (Linnarsson). Middle Cambrian, Sweden. After Linnarsson.

11. *Goniodiscus lobatus* (Hall). Lower Cambrian, Eastern New York. After Walcott.

12. *G. sculptus* (Hicks). Middle Cambrian, Wales. After Lake.

13. *G. parkeri* (Walcott). Lower Cambrian, Vermont. After Walcott.

14. *G. dawsoni* (Hartt). Middle Cambrian. New Brunswick. After Matthew.

15. *Weymouthia nobilis* (Ford). Lower Cambrian. Near Troy, New York. After Ford.

16. *W. nobilis* (Ford). Lower Cambrian, Pearl Street, North Weymouth, Mass. Original.

NOTES ON A CATERPILLAR.

By ANNIE G. H. WHITE, Toronto.

September 22nd, 1912—Found a large green caterpillar of the Cecropia Moth on a lilac bush. Brought it in and put a branch of the lilac with caterpillar under a large battery jar.

Sept. 24—Caterpillar commenced spinning about 10 o'clock a.m.
" 25—Outer wall of cocoon finished; looks like a transparent silk basket.
" 26—Cocoon almost opaque; looks like an airship; egg-

shaped, $3\frac{3}{4}$ in. long, $1\frac{7}{8}$ in. at widest part; caterpillar can still be faintly seen moving.

Sept. 28—Cocoon complete; caterpillar quiet.

Oct. 8—7 o'clock p.m.: heard a scratching noise like tearing of silk, continued all the evening and next day.

" 9—8 o'clock p.m.: must see what is going on, cannot resist.

" 10—The caterpillar life is over and the pupa lies within its silken case, not to move again till June awakens it.

How to tell what I saw! Words can scarcely express its wonder.

I carefully clipped the cocoon with a scissors, making two incisions, to a point at the top, so that I could bend down the section like a door.

The caterpillar lay within the smooth inner wall. It did not look any different than when last seen. Using a large lens, so as not to lose a single item of its proceedings, I set myself to watch. Presently it rose and fell as if heaving a deep sigh; then it began swaying round and round, then from side to side, very much like the motion of a bear.

After some time of this a crack appeared in the skin at the back of its neck. The motion became more violent. Extending itself, it raised its first pair of legs upward as if "throwing high hands to Heaven" in appeal for help. Then drawing back and down it crouched as if in depths of humility or despair. Looking more deeply into the cocoon I saw the object of these movements and also why a caterpillar wears spines and knobs.

In moving, the spines on the segments rubbed against the wall of the cocoon, and assisted in the removal of the caterpillar-skin, which was the object worked for. The crack in the skin had gradually lengthened down the back. Then the head parts and legs seemed to slide downward, just like a child's dress comes off after it is unbuttoned.

Now the new form of the insect appeared. Soft and of a velvety, indescribably beautiful, yellow, the heavy antennæ and legs looking as if made of gelatine. This new creature kept up the swaying till the whole caterpillar-skin was neatly packed beneath it like a concave cushion in which it rested in the bottom of the cocoon.

After this the pupa kept on moving slightly for some time. Then from around the legs and antennæ (which were now folded flat and close) and from the segments a yellowish glassy fluid seemed to ooze, which hardened and turned brown as it covered the pupa till it became as if varnished. All movement now ceased, and I closed the opening with adhesive plaster, leaving the place at the top as near to nature as possible, so that I might see the moth emerge in its full beauty and thus will have watched a part of the life cycle of one of Nature's little children.

PROGRAMME OF WINTER LECTURES.

NOVEMBER 25TH, 1913, (Tuesday). Open Meeting.
Exhibits and Addresses by members.
(Normal School Assembly Hall).

DECEMBER 9TH, 1913, (Tuesday).
"The Old Iroquoian Religion and the Handsome Lake Reform." (Illustrated)
Dr. C. M. Barbeau, Assistant Ethnologist, Geological Survey.
(Normal School Assembly Hall).

JANUARY 13TH, 1914, (Tuesday).
"Forestry and Conservation." (Illustrated)
Dr. Clyde Leavitt, Commission of Conservation, Ottawa.
(Normal School Assembly Hall).

JANUARY 27TH, 1914, (Tuesday).
"The Shedding of Leaves, Flowers and Fruits." (Illustrated)
Dr. Francis E. Lloyd, Department of Botany, McGill University, Montreal.
(Normal School Assembly Hall).

FEBRUARY 10TH, 1914, (Tuesday).
"Protection of Birds in and around Ottawa." (Illustrated)
Dr. C. Gordon Hewitt, Dominion Entomologist, Central Experimental Farm, Ottawa.
(Collegiate Institute Assembly Hall).

FEBRUARY 24TH, 1914, (Tuesday).
"Views in the Dominion Parks." (Illustrated)
Mr. A. Knechtel, Chief Forester, Dominion Parks.
(Carnegie Library)

MARCH 10TH, 1914, (Tuesday).
"The Mackenzie River Region." (Illustrated).
Mr. Charles Camsell, Geologist, Geological Survey, Ottawa.
(Carnegie Library)

MARCH 24TH, 1914, (Tuesday). Annual Meeting and Presidential Address. "The Breeding of Economic Plants."
L. H. Newman, B.S.A., Secretary, Canadian Seed Growers' Association, Ottawa.
(Carnegie Library)

THE OTTAWA NATURALIST

Vol. XXVII. December, 1913 No. 9

A NEW GENUS AND SPECIES OF CERATOPSIA FROM THE BELLY RIVER FORMATION OF ALBERTA.*

By Lawrence M. Lambe, F.G.S., F.R.S.C., F.G.S.A.
Vertebrate Palæontologist to the Geological Survey, Canada.

Styracosaurus, gen. nov.

Skull massive, elongate, pointed in front, and greatly extended behind to form a neck-frill with long, robust, tapering outgrowths projecting obliquely backward and outward from its posterior border. Fontanelles of moderate size within the coalesced parietals. Squamosals somewhat quadrangular and entering largely into the formation of the front part of the frill. Postfrontal fontanelle large. Supratemporal fossæ opening widely behind. Nasal horn-core large, upright, straight, rising from the back of the nasals. Supraorbital horn-core incipient.

Styracosaurus albertensis, sp. nov.

The skull of this species is remarkable for the largeness of the nasal horn-core, the remoteness of the same from the acute rostral apex, and for the great development of backwardly directed spike-shaped processes on the posterior margin of the coalesced parietals.

The horned dinosaur above named is represented by the skull only, which is the type of the proposed new genus and species. This magnificent specimen was discovered last summer in the Belly River formation on Red Deer river, Alberta, by the vertebrate palæontological expedition of the Geological Survey under Charles H. Sternberg. It is almost perfect on the left side and is in a splendid state of preservation. It occurred imbedded horizontally, in a natural position, in a thick layer of light grey clayey sandstone with the neck-frill and the upper surface as far forward as the anterior part of the nasals exposed to view. Later it was found that the lower jaw and the rostral bone were not present. At the time of the discovery of the skull the nasal horn-core had been broken off a little below its mid-height, and the foremost and last of the large posterior processes of the frill on the left side had lost about three and six inches respectively from off their pointed ends. These parts were not found. On the right side, the jugal had fallen to pieces and the lateral border of the frill had suffered some damage from exposure. The posterior processes had been broken off and fractured, but, with the exception of a few fragments, they were recovered and have been restored and replaced in position.

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*Communicated by permission of the Director of the Geological Survey.

The front part of the skull has been crushed down to some extent. This has caused an overlapping of some of the bones, notably at the junction of the nasals with the premaxillæ and maxillæ, and along an irregular line through the lachrymal foramen, the lower rim of the orbit and the lower edge of the postfrontal. The orbits and the lateral temporal fossæ have been reduced in vertical diameter and the left jugal has been squeezed slightly outward below.

This specimen brings to light an entirely new phase of frill development, which is unique among the horned dinosaurs. It may be regarded as one of the most complete and best preserved of the Ceratopsian skulls hitherto discovered in Cretaceous deposits of this continent.

The name selected for this genus has reference to the shape of the large processes on the frill, which resemble spikes, and must have made this bristling reptile in life a veritable moving chevaux de frise.

Viewed from above, the skull presents a facial wedge-shaped portion from the orbits forward, a middle section which broadens abruptly into a somewhat circular expansion and includes the anterior half of the neck-frill, and a hindermost part formed of the widely divergent posterior processes which add so greatly to the length and breadth of the frill.

In lateral aspect the skull is depressed and very long in contrast with its height. The spike-shaped processes double the length of the frill, which, without them, would compare favourably in relative size with the corresponding expansion in later forms of the Ceratopsia, such as Triceratops, in which the orbit is but slightly in advance of the mid-length of the skull. Behind the nasal horn the upper outline is straight, then somewhat depressed near the middle of the crest, finally rising to its highest point at the termination of the hindermost process. The orbital rim rises above and breaks the continuity of the superior outline of the head. Midway between the posterior rim of the orbit and the anterior end of the nasal the straight nasal horn rises abruptly, with a slight inclination forward, and is the most conspicuous feature of the anterior part of the head.

The nasal outline in advance of the horn is highly arched and descends rapidly in front to the premaxilla. The sinuous border of the squamosal slopes upward and backward, and its general direction is continued behind by the anterior free margin of the parietal. From this aspect the processes are given off one above the other in an ascending series. The inferior outline of the premaxilla is obtusely angular and drops to a point considerably lower than the alveolar border of the maxilla. In general terms the skull's greatest depth, without considering the nasal horn-core, is at the orbit, whence it is reduced to some extent forward, and very conspicuously so backward.

At the time of writing, the upper and side surfaces only of the skull had been freed from the matrix. Some of the sutures are distinct and can be traced, others, where coossification has taken place, are not seen with certainty or are entirely obliterated.

The neck-frill or crest is formed of the squamosals and the immense expanse of the coalesced parietals. The main part of the squamosal is slightly broader than long and has its lateral free edge regularly sinuous. Behind this, for a short distance, the anterior lateral border of the parietal is conspicuously tortuous. The massive, tapering projections or outgrowths are given off postero-laterally from the frill, three on each side. These processes conform to the general slope of the part of the frill from which they spring. The two forming the hindermost pair are the largest and are directed backward and slightly outward. Those of the next pair in advance are nearly as large and point more outward than backward. The two anterior ones are the smallest, are nearly parallel to the middle ones and spring partly from beneath them. The processes have a perceptible curve outward. The central part of the posterior border of the frill, between the hindermost processes, is thick and rounded, its outline, as seen from above, being regularly concave with a decided convexity at the base of the processes.

The intraparietal fontanelles are irregularly oval in outline, with the longer diameter from back to front. They are set obliquely in the frill, being slightly divergent forward. They are more distant from each other than from either the central concavity of the posterior border, or the lateral sinuous margin of the frill. Their anterior end approaches closely to the squamoso-parietal suture.

The nasals are greatly enlarged posteriorly for the support of the nasal horn-core, whose anterior basal surface is slightly behind their mid-length. In advance of their union with the maxillæ they send down a short, stout process to meet an ascending process from the premaxillæ. This process is displaced upward and forward on each side of the skull. The one on the left side is seen, in the figure of the lateral aspect of the skull, as a triangular projection silhouetted against the back part of the nasal opening. In advance of the horn the nasals contract rapidly and continue forward as a vertically narrow, laterally compressed arch, which descends anteriorly in a sweeping curve to join the premaxillæ. A vertical nasal septum, contributed to by each nasal, descends from their longitudinal junction to form the upper margin of the nasal opening and in front to join the premaxillæ. This septum supplies to the nasals anteriorly a large vertical surface of contact and greatly strengthens them. An admirable provision for the support of the nasal horn-core is seen in the formation of the nasal bones, which, under the horn, form a massive, transverse arch, and in front a longitudinal arch braced beneath by the septum, the whole wonderfully adapted to withstand heavy strains transmitted from the horn above.

The maxilla narrows rapidly to the front, where it reaches the premaxilla. Its upper half, which is overlapped behind by the jugal, overhangs the lower half, whose concave hinder end is covered by the triangular transverse bone.

The premaxilla has a smooth surface, is narrow in front and flares outward below. In lateral aspect it is obtusely angular in front and beneath. It consists of a well defined marginal strip of nearly the same breadth as, and in continuation downward and backward of, the arched portion of the nasal, standing out from and circumscribing below a sunken, inflected area, which rises as a thin plate to meet the nasal septum anteriorly and to form the lower free edge of the nasal opening behind. It is overlapped at its front angle by the rostral bone, which fits into a sutural groove between the premaxillæ in front and is closely applied to them as far back as the lower angulation. Posteriorly an ascending process reaches the descending process of the nasals.

The exact boundaries between the frontals, prefrontals, postfrontals and lachrymals have not been determined, as these bones were coossified and the sutures between them are for the most part obliterated. The frontals were not large and met in the midline for a short distance only, as indicated seemingly by impressed markings, which appear to be the remains of a fronto-postfrontal suture. The postfrontals, however, were extensively developed. In the midline anteriorly they met for some distance in sutural contact, but posteriorly they were widely separated by a long postfrontal fontanelle. They formed the posterior border of the orbit and met the jugal and the squamosal below and the parietal behind. The upper orbital rim is thickened and overhangs the orbit, and rises conspicuously above the level of the flat postfrontal surface between the orbits. The lachrymal probably forms the anterior rim of the orbit and the prefrontal the overhanging upper margin of the same. Set well back posteriorly on the raised ridge above the eye-opening is a small, shallow, smooth depression, irregularly oval in outline, which indicates the position of an extremely small, or incipient, supraorbital horn-core, which appears to have been present as a separate ossification and to have become detached.

The jugal had much the same shape as in Triceratops; it was pointed below, and, in its upper part, extended to either side, anteriorly to overlap the maxilla and posteriorly to meet the squamosal. It formed the lower rim of the orbit and the whole of the upper margin of the lateral temporal fossa, which was enclosed below by a forwardly directed process from the squamosal. The thin upper end of the quadratojugal is wedged between this process and the quadrate, which is seen in the lateral aspect of the skull, passing beyond the quadratojugal to effect a union with the under surface of the squamosal.

The squamosal is well developed, of a fair size, roughly quadrangular in shape, and a little broader than long on its main outer surface. At the middle of its anterior breadth it sends forward an outwardly flat process, which encloses the lateral temporal fossa below and behind. Its lateral free margin is smooth, rounded, and regularly undulating with five somewhat vertically compressed convexities to the outline.

The neck-frill in its anterior half is saddle-shaped. The surface of the coalesced parietals between the fontanelles is equal to their transverse diameter and is flatly convex across and slightly concave longitudinally. The bone surrounding the fontanelles is very thin at the edge. Between these openings it remains moderately thin, but toward the lateral free edges and posteriorly it becomes thickened, especially so at the bases of the large processes and along the posterior border. Behind each fontanelle the surface of the bone rises into a rough, obliquely placed short ridge or keeled boss. Proximally the posterior processes are somewhat vertically compressed, but outwardly they become more nearly circular in transverse section. The median portion of the coalesced parietals is continued forward, in advance of the fontanelles, as a distinct raised surface with parallel sides, to meet the postfrontals, where it probably formed the hinder margin of the postfrontal fontanelle. This anterior part of the parietal is damaged, but on each side of the posterior end of the postfrontal fontanelle and between it and the supratemporal fossa a small part of it remains, shewing its sutural contact with the postfrontal. Where the upper median portion of the parietal has been broken there is a short transverse bar across the midline, which appears to mark the posterior limit below of the postfrontal fontanelle. Behind this bar is a small, shallow, oblong depression. The very large excavations beneath the postfrontals, the supratemporal fossæ, debouch widely backward with a smooth, lower surface, or floor, formed of the parietal and the squamosal. Although mainly beneath the postfrontal, this fossa extends laterally at its exit beneath the squamosal on the outer side, and the anterior end of the parietal inwardly, these three bones together composing the roof of the excavation at its mouth where they come to a sharp, overhanging, free edge, which slopes upward from about the middle of the back part of the squamosal, obliquely forward and inward and then descends backward, apparently without interruption, if the specimen were perfect, as the lateral edge of the median portion of the parietal. The smooth floor of the supratemporal fossa extends backward beyond its main opening toward the anterior end of the parietal fontanelle and inward beneath the median portion of the parietal, which it undercuts, leaving a free, overhanging edge, and at a higher level enters a subsidiary fossa, which is directed obliquely inward and backward and terminates next to the midline of the skull, where it is separated only by a thin bony partition from the corresponding excavation on the other side. These subsidiary fossæ, one on each side of the midline, beneath the parietal, are behind the transverse bar already mentioned,

The parietal crest evidently rose behind at a rather steep angle during the life of the animal. In the specimen now described the crest has been crushed and bent downward, with the result that the parietal has been broken across behind the postfrontal fontanelle and pulled back, leaving the gap in the upper surface, as seen in the two photographic reproductions of the skull accompanying this paper.

The bone forming the margin of the postfrontal fontanelle comes to a thin rounded edge and within the fontanelle near its anterior end is another transverse bar not so stout as, but longer than, the one behind.

The lachrymal foramen is seen between the maxilla and the nasal in advance of the back end of the former bone. It has been reduced in vertical diameter by the downward pressure to which the skull has been subjected.

As with most Ceratopsia, the outer and upper surfaces of the skull are marked by vascular grooves, notably so on the horn-core, the postfrontal above, and the posterior processes.

The magnificent specimen here described has been skillfully prepared for study by Mr. Charles H. Sternberg, who discovered it last summer on Red Deer river, Alberta, on the south-west side of the river, about twelve miles below the mouth of Berry creek. The plates are reproductions from excellent photographs taken by Mr. Geo. G. Clarke.

The genus Styracosaurus is distinguished from Ceratops, Marsh, by having incipient instead of well developed supraorbital horn-cores, by the shorter squamosals, and by the intraparietal fontanelles of moderate size, instead of greatly enlarged ones enclosed by the squamosals and parietals together.

From Monoclonius, Cope, it differs in its greater size, the smaller fontanelles of the frill, the larger squamosals, and in having a straight, upright nasal horn instead of one which curves backward.

In Styracosaurus the shape and position of the nasal horn-core, the spike-shaped outgrowths from the back of the frill, the long postfrontal fontanelle, and the great size of the supratemporal fossæ are additional characters separating this from all other known genera of Ceratopsia.

It is not possible to arrive at a definite conclusion regarding the generic and specific affinities of *Monoclonius sphenocerus*, Cope, from Montana, on account of the fragmentary condition of the material on which this species is based, and the very small part of the skull represented. The general resemblance of Cope's specimen, which includes the nasals, the nasal horn-core and the left premaxilla, to the corresponding parts of *Styracosaurus albertensis* suggests the advisability of referring the Montana species to the genus Styracosaurus. It is likely, however, that the species are not the same. In so far as a comparison can be made between *M. sphenocerus* and *Styracosaurus albertensis* it is seen that in Cope's species the nasal horn-core is farther forward on the nasals, is proportionately shorter, and more laterally compressed, with a much greater antero-posterior diameter at the base. The nasals in front of the horn descend rapidly instead of rising conspicuously before they curve downward, and the nasal opening is larger and placed more under the horn. These differences are regarded as probably indicating a specific but not a generic distinctness.

MEASUREMENTS.	Feet.	Inches.
Maximum length of specimen from midway between the points of the back processes..	6	1¼
Greatest breadth of same across the processes..	4	8½

	Feet.	Inches.
Length of squamosal from the posterior termination of its free edge to the back margin of the jugal	1	$3\frac{5}{8}$
Breadth of same from its lowest point to the top of the squamoso-postfrontal suture......		$12\frac{2}{8}$
Length of nasal horn-core as found..........		$9\frac{7}{8}$
Transverse diameter of same, at break		$2\frac{5}{8}$
Longitudinal " " " " "		$3\frac{7}{8}$
Transverse diameter of same, at base..........		$4\frac{3}{8}$
Longitudinal " " " " "		$6\frac{3}{8}$
Length of nasal horn-core as restored........	1	$9\frac{6}{8}$

NOTE—Since the above was written, a specimen collected last summer and consisting of the squamosal, jugal and postfronal of the right side, with the front margin of the orbit completing the circumference of the eye-opening, proves to be referable to *S. albertensis*. This specimen was obtained from the Belly River formation, about four miles up stream from where the type was discovered. In it a narrow, flat process is seen to proceed backward from the jugal below the lateral temporal fossa and to overlap the forwardly directed process of the squamosal as far as the middle of the lower margin of this opening. This process was not at first recognized in the type, but is now clearly seen. It has been broken from the main portion of the jugal, but is in place between the posterior termination of the quadratojugal and the lateral temporal fossa. In all particulars this second specimen fully agrees with the type. Above the eye a similar smooth surfaced depression marks the position of the supraorbital horn-core and the free margin of the postfrontal fontanelle and supratemporal fossa is present

EXPLANATION OF PLATES.

PLATE X.—Lateral aspect of type of *Styracosaurus albertensis*, one-twelfth the natural size.

PLATE XI.—The same specimen viewed from above and similarly reduced.

PLATE XII.—Restored outline of the same specimen, viewed from the side and similarly reduced.

Abbreviations.—*F*, frontal; *J*, jugal; *L*, lachrymal; *MX*, maxilla; *N*, nasal; *NO*, nasal opening; *P*, parietal; *PF*, postfrontal; *Q*, quadrate; *QJ*, quadratojugal; *S*, squamosal; *SH*, surface for supraorbital horn-core; *SR*, surface for overlap of rostral; *T*, transverse; *A*, parietal fontanelle; *B*, postfrontal fontanelle; *C*, supratemporal fossa; *D*, lateral temporal fossa.

BIRD NOTE.

PILOT MOUND, MAN., Sept. 18.—My opposite neighbour has a nest of *Spinus tristris*, the goldfinch, with two half-fledged nestlings out of a clutch of four eggs. Two of the eggs did not hatch out. I wonder whether Mr. Norman Criddle can beat this for a record of late nesting in Manitoba. Usually we have frost enough by Sept. 15th to kill all half-hardy plants in the garden, but this year we have escaped frost entirely, up to date.

H. M. SPEECHLY.

NEW AND OTHERWISE INTERESTING LICHENS FROM VANCOUVER ISLAND AND THE ROCKY MOUNTAINS.

By G. K. MERRILL.

Parmelia olivacea var. multisporum (Schneid.) Merl. Bryologist XII, 4, 1909, p. 73.

Alder trunks. Sidney, Vancouver Island; Prof. J. Macoun. Asci containing from eight to forty spores. The eight-spored conditions absolutely inseparable from *P. olivacea*, and no reason appears for giving the polysporous anomaly other than a varietal rank.

Lecanora (*Callopisma*) **atrosanguinea** sp. nov.

Thallus effuse, thin, whitish or ashy, smooth or roughened, K—, C—. Apothecia sessile, small (less than 1 mm.), at first plane, then convex, opaque or shining, rounded or lobed, sometimes connate or composite, often proliferous, margin persistent, slightly elevated, concolorous with the blackened-crimson disk. Spores 8, ellipsoid, the terminations acute, polar-bilocular, 15–18 x 10-11μ, hypothecium reddish, asci ventricose, paraphyses distinct, slender, coherent, tips dark or reddish-black, hymenium in section gives a violet or purple reaction with K.

Trunks of willows, alders and birches. Sidney, Vancouver Island; Prof. J. Macoun. Type in herbarium Merrill. Differs from *L. ferrugineum Pollinii*, for which it might be mistaken in the color of the apothecia, epruinose disk, and the persistent and concolorous margin.

Lecanora epibryon Ach. Syn. p. 155 (1814).

L. subfusca b. *hypnorum* Schaer, of Tuckerman's Synopsis. Humus and decayed mosses. Yoho Valley, British Columbia; and mosses, Jumping Pound Creek, Athabasca; Prof. J. Macoun.

The specimen from Yoho Valley is remarkable from affording a hymenial reaction with Iodine like that of *L. subfusca*. The apothecia are medium, disk somewhat convex, blackish, with an inconspicuous fuscescent exciple. The apothecia of the Athabascan plant are concave with an elevated exciple similar in color to the thallus.

Lecanora (*Rinodina*) exigua (Ach.) Nyl. Flora 1873, p. 197.

Rinodina sophodes e. *exigua* Fr. of Tuckerman's Synopsis. Trunks of willows, maples, alders and Douglas fir. Sidney, Vancouver Island; Prof. J. Macoun.

The various specimens present a great diversity of coloration and conditioning for the thallus. The colors, white, whitish-ashy, ashy to sordid-glaucous, and the thallus from smooth and continuous to verruculose or rugged and more or less rimulose. The spores are variable in size and shape, ranging from 10-26 x 7-14μ, either bilocular with approximate sporoblasts, the cells without nuclei, or more or less nucleolate with a connecting canal visible. In the greater part of the material the thalline margin of the apothecia is perfectly to be made out, and is variously entire or crenulate, but a condition occurs in which the margin is obliterated, and the plant may then be correlated with:—

Lecanora exigua forma **lecideoides** (Crom.) comb. nov.

L. exigua var. *lecideoides* Cromb. Grevillea XVIII, p. 46 (1889).

Apothecia black, convex, and the magrin wholly excluded. Found on willows with the species.

When found unassociated with the normal forms of the species, the present may easily be mistaken for a *Lecidea* of the section *Buellia*. The hypothecium is destitute of color, however, and in thin section algae are always to be found in the envelope.

Lecanora exigua forma **pruinosa** f. nov.

Entirely like the species in thallus, apothecia and spores, and differing only in that the disk of the apothecia becomes gray-pruinose. The pruina does not extend to the exciple. The very dubious *Rinodina Hallii* Tuck. Synopsis, Pt. I, p. 208, in some of its exhibits is no different from the present. On the same trees with the species.

Sidney, Vancouver Island; Prof. J. Macoun. Type in herbarium Merrill.

Lecanora (*Rinodina*) colobina Ach. Lich. Univ. p. 358 (1810).

Thallus effuse or sub-limited, thin, granulate, the predominent color blackish. Apothecia small (0.05 mm.), adnate, plane, the disk black with a conspicuous thickened entire margin. Spores 8, ellipsoid, bilocular, nucleolate, with a connecting canal, 20–25 x 10–12μ, paraphyses distinct. Willows. Sidney, Vancouver Island; Prof. J. Macoun.

Previously unrecorded from America.

Phlyctis speirea sp. nov.

Thallus effuse, tartareous, granulate, cinereo-glaucous, K + red. Apothecia small, difform, erumpent, the thalline margin irregular, lacerate-dehiscent, margin white, nucleus depressed, darker. Spores 2, ellipsoid or oblong-ellipsoid, muriform, hyaline, or yellowish, 100–120 x 25–40μ, hymenium and hypothecium without color, paraphyses distinct, slender, discrete, asci inflated, hymenial gel. with I+ faint blue.

Bark of willows. Sidney, Vancouver Island; Prof. J. Macoun. Near to *Phlyctis argena* (Ach.) Koerb, but differing in the color of the thallus and aspect of the apothecia. The whole appearance of the plant is that of a *Pertusaria*. Type in herbarium Merrill.

Biatora (*Biatorina*) **Griffithii** var. **Pacifica** (Tuck.) comb. nov. *Biatora mixta Pacifica* Tuck. Syn. Pt. 88, p. 30.

Thallus thin, ashy for the most part, limited and decussated by black hypothalline lines. Apothecia small to minute, depressed, plane or convex, from waxy, through various shades of brown, or finally blackening, sometimes pruinose, margin persistent or sub-persistent, but not conspicuous, not showing the color mutation of the disk and commonly brown. Spores 8, fusiform or oblong-ellipsoid, straight or curved, one-septate or rarely with two septa, 12–15 x 4–5μ, hymenium and hypothecium without color, asci ventricose-clavate, paraphyses distinct, coherent, epithecium fuscescent downward, hymenial gel., with I + intense blue.

Bark of alders, willows, oaks and other trees. Sidney, Vancouver Island; Prof. J. Macoun.

Apothecia sometimes strongly convex, blackening, and excluding the margin. When the disk is pruinose or light colored the margin is conspicuous from its darker hue.

Biatora (*Biatorina*) **Columbiana** sp. nov.

Thallus effuse, thin and granulate, or thicker and areolate, cinerous or greenish-cinereous. Apothecia small or moderate (1–2 mm.), at first concave with a relatively thick margin, but ultimately strongly convex and immarginate, brownish-black or black, the margin concolorous. Spores 8, ellipsoid or fusiform-ellipsoid colorless, 16–18 x 4.5–6μ, hymenium hyaline or suffused with purple, hypothecium blue or green, asci clavate or ventricose-clavate, paraphyses distinct, slender, discrete, tips purple, hymenial gel., with I + blue. Bark of alders, maples and Douglas fir. Sidney, Vancouver Island; Prof. J. Macoun.

The affinities of the plant are with *B. Laureri*, and *B. atropurpurea*.

The hypothecium is often imposed on a stratum of confused hyphema of a distinctly purple color. Under the microscope the hymenium is a beautiful object.

Biatora (*Bilimbia*) sabuletorum forma simplicior Nyl. Scand. p. 205 (1861).

Thallus not differing from that of the species. Apothecia within brownish-yellow. Spores variable in form and size, oblong or fusiform-oblong or somewhat cymbiform, usually one, sometimes two or three septate, 11–18 x 4–5μ, asci inflated-clavate with a thick apical wall, hypothecium sometimes fuscescent, hymenial gel. with I + blue.

Over mosses. Pipestone Pass, Rocky Mountains; Prof. J. Macoun.

Not heretofore recorded from a Continental North American station.

Biatora (*Bilimbia*) **syncomista** (Flk.) comb. nov.

B. artyta (Ach.) Tuck. Gen. p. 162 (1872).

Mosses over rocks. Pipestone Pass, Athabasca; Prof. J. Macoun.

Th. M. Fries in Lich. Scand., Pt. II, p. 336, states that the original specimens of *Lecidea artyta* Ach., as designated in the Acharian herbarium, are to be referred to *Stereocaulon tomentosum* b. *alpinum* and *S. denudatum* b. *pulvinatum*. Acharius in Synopsis p. 20, cites *Lecidea sabuletorum* b. *syncomista* Flk. in Berol. Mag. 1808, p. 310, as equivalent to his own *L. sabuletorum* b. *geochroa*. On page 33 of the Synopsis he defines *Lecidea artyta*. This may only be construed as a definite opinion of the distinctness of the two plants. Schaerer in Spiclg., p. 151, cites *L. artyta*, *L. sabuletorum geochroa* of Acharius and *L. sabuletorum* b. *syncomista* of Floerke as synonymous with his own *L. sabuletorum* b. *muscorum*. Tuckerman asserts that Schaerer knew *Lecidea artyta*, as sent to Acharius by Schleicher, and there is evidence that he was acquainted with the Floerkeian plant, for it is cited with a mark of emphasis. There seems to be a total lack of definite knowledge regarding *L. artyta*, and Tuckerman's effort to save the name is merely an example of ingenious inference. While in most of the essentials the authors agree in their descriptions of the species, there are discordances that prove perplexing. The hypothecium is noted to be extremely variable in color, ranging from yellowish to deep black, and the hymenial reaction is given as blue, deep-blue, violet, blue followed by violet and sordid-violet, sordid-yellow or wine-red. The following description of our specimen is inserted for purposes of comparison.

Thallus indeterminate, granulose-squamulose, the squamules small, thickened, crenate-lobulate, more or less contiguous, grayish-white K—, C—. Apothecia sessile, aggregated, often 3–7 connate, plane and thinly margined when young, at length strongly convex and immarginate, disk blackish-brown with the epithecium roughened. Spores ellipsoid, oblong-ellipsoid or cymbiform, one to three septate, 14–34 x 3–6μ, paraphyses distinct, concrete or somewhat lax, bluish-green at the apices, hypothecium reddish-brown, hymenial gel., with I + blue, the color persisting.

The species is reported from Port Clarence, Alaska, Greenland and Newfoundland, under the generic synonym of *Lecidea* of its section *Toninia*, and from Lake Nipigon, Ontario, Arctic America, Islands of Behring Straits, and from the Canadian Rockies under the name of *Biatora artyta*.

Lecidea sublatypea Leight. Lich. Flora G. Brit. ed. I, p. 271 (1871).

Thallus effuse or sub-determinate, granulate, ashy-fuscous, K—, C—, Apothecia small (0.5 mm.), sessile, scattered or connate, plane or concave, with a persistent or evanescent, opaque or shining entire margin, disk black. Spores 8, ellipsoid, simple, 12 x 6.5μ, hypothecium brown, asci ventricose, paraphyses distinct, compacted, tips blackish-green, hymenial gel., with I + deep-blue.

Granite rocks. Sidney, Vancouver Island; Prof. J. Macoun. Previously unreported from America.

Xylographa micrographa sp. nov.

Thallus hypophlaeous, the hyphema ramifying through the superficial fibers of the substratum, algae Palmella, few and scattered, K—, C—, Apothecia innate, scattered, parallel with the fibers, small (less than 1 mm. in length), lirelliform or fusiform, accuminate, typically concave, but sometimes plane, with a prominent slightly inflexed margin, or the margin reduced and the disk nearly plane, black. Spores 8, ellipsoid, simple, nebulous, filled with granular protoplasm or developing nucleoli, 11–13 x 7μ, hymenium and hypothecium colorless, asci inflated-clavate, paraphyses distinct, slender, lax, abundant.

Old decorticated log. Sidney, Vancouver Island; Prof. J. Macoun.

The thallus visibly whitens the wood, and is effuse. The internal characters ally the plant with *X. parallela* (Ach.) Fr., the external with *X. hians* Tuck. Type specimen in herbarium Merrill.

Rockland, Maine.

SOME RARE CASES OF ALBINISM IN ANIMALS.

By Professor Edward E. Prince, LL.D., D.Sc., F.R.S.C.
Dominion Commissioner of Fisheries, Ottawa.

In a paper which I contributed to The Ottawa Naturalist, Nov., 1906, I summarized my views upon the large subject of Animal Coloration, and I dealt with the evolution of the colors of living creatures, attempting to classify exhaustively a large variety of examples known to me. In referring to "Physiological Coloration" I made mention of a closely allied phenomenon, which I regarded as "Pathological," and due to abnormal or diseased conditions, grouping thereunder albinos, such as white crows, hawks, peacocks, moles, etc. I mentioned, as a likely cause, a diseased or defective peripheral nerve supply; a white hedgehog (*Erinaceus*) being found to have an abnormal condition of the peripheral nerve twigs ending in the skin, and resulting in a lack of the usual color or pigment in the integument, or rather in the spines and hairs developed from the skin. I stated that, according to Darwin, white cats have blue eyes, are, as a rule, deaf, and, if Dr. Lawson's statement be correct, are always tom-cats. The eyes of most animals are dark or colored, owing to pigment massed in the retina, and in the iris; but in albinos, color being absent, the retina is without it and the rich blood-supply renders the eyes red or pink, as well as the nose and tips of the ears, as in albino rabbits and white rats and mice.

All white animals are not albinos, because the absence of color in the fur or plumage may be due to seasonal and other normal causes. Thus the grey harbour seal is snow white when very young, but its nose and eyes are jet black. The Polar bear, Arctic fox, the stoat or ermine, the varying hare, the ptarmigan, and other animals, are permanently or seasonally white, and thus resemble their wintry surroundings. Dr. Starr Jordan observes that the white color of Arctic animals may be useful not alone in rendering them inconspicuous, but may also serve a direct physiological function in preventing loss of heat from the body by radiation. He adds, "the dark colors of animals may be of value in absorbing heat rays and thus helping to keep them warm. But by far the most widespread use of color is to assist an animal in escaping from its enemies or in capturing its prey." Now, while cold and dryness tend to produce whiteness, damp and warm conditions result in darkening the fur or plumage and the external color of animals generally.

"Melanic varieties, as they are termed," says Beddard, "often occur on islands and other situations where the climate is moist as well as warm." On the other hand, in such a country as New Zealand, white, or what are called albino, varieties of birds, and many living forms, are said to be frequent owing to very dry seasons or periods of drought, and to the presence of snow on the lofty ranges of mountains, which for height and grand scenic features resemble our own Pacific coast mountains. The whitening process in our Northern Hare (*Lepus americanus*, Erxl.) has been carefully studied, and it has been proved that the summer coat actually bleaches, but the change is accompanied by a growth of new hair, so that the coat is thicker than in summer and the hairs are longer. The outer border of the ears remains black, but the rest of the fur becomes pure white, the blanching successively passing from the black tip of each hair down the reddish middle part to the basal leaden-colored part. The hairs of the forehead and shoulders are the last to change and a few long black hairs are always present above and below the eyes and extend backwards. One observer, Mr. Welch, tells us that the entire change occupies about three months, from early in October till late in December, but further north, in the latitude of Quebec, it is said to be, usually, early in November, and the whitening is also more rapidly accomplished. Sir John Ross observed a lemming on board his vessel change color in a week, in February. Whether the assumption of a white winter coat is due to Arctic environment, or to natural selection and heredity (the white examples surviving when other examples were more readily seen by enemies and exterminated), it is not necessary here to discuss. The brown musk-ox, the black raven, the sable and other northern animals do not change, and thus the matter is a complicated one. But the term albino should not be applied to forms which are white normally, or turn white seasonally as an established feature in their life; but should apply rather to the somewhat erratic and abnormal cases of whiteness and lack of normal coloration due to some congenital cause, apparently allied to a diseased or pathological condition.

An extremely rare and interesting case of this true albinism was discovered this season (1913) at the St. Andrew's Biological Station, New Brunswick. A specimen of the common sea-urchin (*Strongylocentrotus drobrachiensis*) of our Atlantic shores, over three inches in diameter, instead of exhibiting the reddish purple and variegated colors of typical specimens, was of the purest chalk-white, the plates of the somewhat depressed globular test or shell, as well as the crowded sharp-pointed moveable spines, being entirely destitute of color. Even the eye spots, which are rudimentary colored visual organs on the five ocular plates, alternating with the five genital plates round the periproctal space at the aboral pole, did not show any pigment. It was a perfect albino, and, so far as I have been able to ascertain, the first albino sea-urchin ever seen. It was a beautiful object, appearing as though its characteristic apple-shaped form were delicately carved in white marble. It is now conspicuous in the faunal collection of fishes and invertebrates at the Dominion Biological Station, St. Andrews, N.B.

An interesting albino specimen of the lobster (*Homarus americanus*), from the Pictou shore, Nova Scotia, came into my possession some time ago. Pale tinted specimens of lobsters have long been known, some of which, in place of the dark blackish blue of the usual type, show reddish or yellowish coloration; but the specimen which I secured was dappled all over with irregular patches of yellowish white and the blue-black color was confined to small, irregular spots, chiefly on the upper parts of the tergum, or dorsal portion of the body and tail-segments. This very unusual specimen was only 8 inches in length and cannot have been more than three or four years old. It might be suggested that, instead of being an albino, the specimen merely retained some of the varied coloration of the infantile stages, for when half-an-inch long, at the stage when salts of lime and pigment first appear in the delicate shell, the general color is maroon, or sometimes pale brown with green intermingled, and especially prominent are some chalk-white spots, four or five in number, apparently marking the attachments of the tendons of the cephalo-thoracic muscles inside. These spots are even more distinct at the sixth stage, about the fifth week after hatching, when its length is three-fifths of an inch. At the seventh stage (seventh week), when three-quarters of an inch in length, a definite pigment layer appears below the external cuticle. In the adult lobster this pigment layer, called by Dr. W. B. Carpenter the areolar layer, is a canaliculated stratum crowded with lime salts, and is hypodermic in origin, and mainly constitutes the thick, dense shell. A tubular layer occurs beneath, likened by some authorities to dentine, being thick and dense, and forming the gleaming white part which is seen when the shell is broken. Lowest of all is a thin lamellar non-calcified layer. The color in the areolar layer is due to chromogens, which are converted by boiling, dehydration by alcohol, etc., and even by exposure to excessive light, into a red lipochrome. Every one is familiar with the change, by boiling, of a dark blue or blackish-green lobster into a bright scarlet one. The normal prevailing color of lobsters on the Atlantic coast is blackish-blue, sometimes of a greenish cast, those on rocky bottoms being darkest, as off the western Nova Scotia shores, but on sandy, shallower areas, as off Prince Edward Island, the color is paler, and often greenish or even brownish.

Professor Herrick records a very black specimen, only 6 or 7 inches long, found among eel-grass in three-fathom shallows off the Maine coast, and the captor, a fisherman, thought at first that it was coated with coal-tar. It was regarded as a melanic specimen, and it may be mentioned that melanism has been noticed also in crabs. Abnormally colored lobsters have been reported of a red or reddish-yellow color, when alive; others are cream colored, i.e., color is practically absent, but mottled specimens, blue-green and yellow, are not rare, while pied examples, showing bold green and light yellow spots, are less common. The specimen secured by me was, in the main, of a yellowish-white, as already stated, but small blue-black spots occurred here and there, on the highest parts of the back. No doubt the example was a pathological or "abnormally physiological" specimen and a near approach to the typical albino.

The third case of albinism recently brought to my notice is that of an albino porpoise (*Phocæna phocæna, L.*), which was captured in Scotland, and a photograph of which was sent to me by my friend Professor McIntosh, F.R.S., of St. Andrews. The *London Globe*, some years ago, gave an account of an English specimen obtained near Ventnor, Isle of Wight, which was described as white, but of a reddish color on the under side. It was shipped alive to the famous Brighton aquarium and exhibited there, according to a correspondent, Mr. R. Blake, of Ventnor.

The normal color of the porpoise, as is well known, is a deep, shining black, but the breast and under surface is dirty white; but this albino specimen, studied at the Gatty Marine Biological Station, St. Andrews, Scotland, was a female of a dull yellowish color, with a faint longitudinal band, somewhat dusky, along the upper lateral region on each side, while a band of the same dusky appearance curved in a crescentic course round the front of each eye, reaching to the corner of the mouth. It measured 2 feet 10 inches in length and was rather more than half grown. Professor McIntosh notes that it seemed to retain the coloration of the very young porpoise, for a specimen 6 inches long, secured at St. Andrews, on Nov. 18th, 1911, was dusky over the dorso-lateral region, the head very dark above as far as the neck and the breast flippers, dorsal fin and horizontal tail-flukes were blackish, the under surface of the last being very dark. An older specimen, also before birth, and obtained on Feb. 6th, 1912, was 17 inches long and the color of the young specimen was now replaced by deep black, but becoming paler down the sides. Adult specimens of various whales show at times increase in white coloration. Thus the Humpback (*Megaptera*) is black above, but white beneath, varied with black spots, but sometimes the black underneath decreases to an indefinite marbled arrangement, or, in some cases, the black disappears and the under surface is white. The huge rorquals or fin-back whales show similar variations, and Mr. Lyddeker surmises that age or special food causes this tendency to albinism. The Right whale of the Arctic is very black above, but white beneath and where the two tints meet there occur irregular patches of white extending into the black color. The Killer whale or Grampus is black above, but in one specimen I observed a white patch above each eye, or there may be a white patch below the eye and a transverse crescentic patch of white behind the huge erect dorsal fin.

It is hardly necessary to point out that the albino porpoise above described recalls the small beluga or white-whale (*Delphinapterus leucas*, Pallas), which is creamy white all over and abounds in the mouth of the River St. Lawrence and round Hudson's Straits into Hudson's Bay, and along Baffin's Land and as far north as Barrow Straits.*

Mr. A. P. Low expressed the view that the white-whale industry might become an important one in many places in Hudson Bay and Straits owing to its abundance, and the Hudson Bay Company, as well as the Eskimo, have long taken considerable numbers for oil and leather, while the boiled skin is a native dainty and the dark colored meat is also used as food.

It is impossible in this place to enter into the somewhat profound and complicated subject of the origin of albinos, and to define the essential differences which divide them from merely pale examples, or seasonal varieties. Melanism can be explained partly at any rate, as due to environment, but albinism is no doubt due to causes which are congenital, possibly pathological. Merely white varieties are not albinos, and the so-called albino skunk, reported as seen last year in Delaware Park, near Buffalo, was not an albino.

Curator Crandall, who saw it, described it as blue, with apparently no black or white hairs intermingled and it may be compared to the blue variety of Arctic fox, which is blue, or rather slate grey, all the year round, and less numerous in the more northerly regions than in the more southerly. In the litters of this blue variety of the Arctic fox there frequently occur pure white specimens, but a whole litter of white cubs has not been recorded. Some interesting figures in a recent report of the Conservation Commission may be here referred to. Thus on St. George Island (Pribyloff Islands), in a total of 772 so-called blue foxes killed in 1897, no less than 40 were white. In 1898, 18 were white in a total of 885 foxes, but in 1903 only 15 were white, out of 1,061 foxes taken, and in 1907-8, out of a total of 1,005 only 8 were white, indeed, only 3 were pure white, the others were bluish white. These pale or white specimens are not valued, and every effort is made to exterminate them and prevent the increase of a white variety. The ordinary variety of dirty brownish colored Arctic fox, which turns pure snow-white in winter, though recently fashionable, was not many years ago regarded with contempt by fur dealers, and Indian trappers were usually "called down" severely for taking the trouble to bring such little-valued pelts to Edmonton and other fur-receiving centres in the North-west.

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*Lilljeborg states that the young beluga is greyish-brown in color.

White deer, like white house-sparrows, have not unfrequently been reported, but whether such are true albinos with pink eyes is not recorded. A red deer of almost snowy whiteness was reported up the Gatineau region some years ago. A white form of the Scottish red deer has been established as a distinct variety, and in Welbeck Park, Langley Park, near Slough, Windsor, and Woburn Castle, in England, there are herds of cream-colored or white deer, believed to be originally of German origin, though the Duke of Portland has regarded them as a Danish variety. It is interesting to note that a creamy or white colored variety of the black bear was discovered not many years since in British Columbia, north of Rivers Inlet, and at the head-waters of the Skeena River and at other points. This small bear has been called "*Ursus Kermodei*" by Hornaday, who first described it.

The whole subject of albinism is deserving of investigation, but it may be clearly stated that white animals, whose eyes are dark, or the tips of the ears, the tail, tip of the nose, etc., are black, are really not albinos, for albinism in mammals involves pink eyes, pink nose, and a general absence of pigment.

MEETING OF THE BOTANICAL BRANCH.

November 8th, 1913, at the residence of Mr. R. B. Whyte. Owing to the rainy weather only a small number of members were present.

After a short discussion it was decided that, for the meetings of the approaching winter, the members should bring to each meeting specimens of botanical interest for exhibition and discussion. It was thought that the adoption of this suggestion would make the meetings more interesting and educative. It is hoped, therefore, that the members will respond heartily in bringing material for each meeting's discussion.

It was then decided that those present, who had made interesting observations during the summer, should give the others present brief accounts of them. Mr. H. T. Gussow very entertainingly described some broom-growths he had seen on trees in British Columbia and some experiences he has had with the seeds of a certain mistletoe growing in the same part of the country. A little later in the evening he also referred to bacteria of the soil in their relations to soil fertility, and to the disease potato scab. Mr. L. H. Newman gave a short account of the recent activities of the Canadian Seed Growers' Association, referring chiefly to the efforts which are being made to produce corn and potatoes of a high standard quality and in quantities large enough for wide distribution.

J.R.F.

BOOK NOTICE.

FORTY-THIRD ANNUAL REPORT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO. This publication has recently made its appearance and we are glad to see fully maintains its previous reputation. It contains no less than 23 papers contributed by the leading entomologists of Canada. These contributions cover a wide field of research and on account of their economic value should be in the hands of every Agriculturist and Horticulturist not alone in Ontario, but throughout the whole Dominion, for, while the papers deal more particularly with Ontario pests, the insects discussed recognize no boundaries and are often as injurious without as within. This, too, applies with equal reason to pests discussed from other provinces which, though comparatively harmless in Ontario to-day, may at any time become troublesome. Thus we find articles wisely included from various provinces, all of which add to the value of the report. It is, as usual, profusely illustrated, and contains as a frontispiece a portrait of the Society's President for 1912, Dr. E. M. Walker.

N. C.

THE OTTAWA NATURALIST

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ON THE FORE-LIMB OF A CARNIVOROUS DINOSAUR FROM THE BELLY RIVER FORMATION OF ALBERTA, AND A NEW GENUS OF CERATOPSIA FROM THE SAME HORIZON, WITH REMARKS ON THE INTEGUMENT OF SOME CRETACEOUS HERBIVOROUS DINOSAURS.*

By Lawrence M. Lambe, F.G.S., F.R.S.C., F.G.S.A.
Vertebrate Palæontologist to the Geological Survey of Canada.

An unusually perfect skeleton of a carnivorous dinosaur, lately added to the collections of the Geological Survey, is of special interest on account of the preservation in it of one of the front legs. The specimen comes from the Belly River formation on Red Deer river, Alberta, and forms part of the very large collection of reptilian and other remains made last summer by the vertebrate palæontological party which explored the rich dinosaurian beds below Berry creek.

The structure of the fore-limb in the large carnivorous dinosaurs of the Cretaceous has been to a great extent conjectural. In this new specimen the right limb is preserved and it is hoped that the left one will be revealed as the work of removing the sandstone matrix proceeds.

The first impression received of the fore-limb is its extremely small size.

The arm has been pressed upward so that the humerus lies beside the back border of the blade of the scapula with its front face directed forward and its inner surface outward, its head remaining within the glenoid cavity.

The fore-arm is flexed downward and the manus is closed with the claw-bones uppermost. The ulna and radius lie together, and the digits, of which there are two, are in place. From the regular succession of the phalanges of the digits to each other it is presumed that none of them is missing. The digits are regarded as Nos. II and III, and there is a vestigial metacarpal IV, consisting of a short, slender bone, slightly curved and tapering to its distal end.

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* Communicated by permission of the Director of the Geological Survey.

Metacarpal II is very short, being only about one-half the length of metacarpal III. There are only two phalanges to digit II, an elongated one and a comparatively large, laterally compressed, curved and sharply pointed ungual. In digit III the first phalanx is short, the second long, and the distal one claw-shaped but smaller than that of digit II. In the ungual phalanx of digit II there is a decided claw-groove. The first phalanx of digit II and the first and second of digit III have a deep pit on each side of the distal end. In the corresponding part of the metacarpals there is only a slight irregular depression.

Four carpal bones are preserved between the ulna and radius and the metacarpals, but they are slightly displaced. One is roughly discoidal and larger than the others, which are compressed ovoid in shape. The largest one occurs at the proximal end of metacarpal III, the other three lie together at the distal end of the radius. The ulna and radius are solid except for a small axial area of cancellous bone.

As already mentioned, the elements of the manus follow each other in regular succession and are apparently all in place with none of the phalanges missing. The phalangeal formula revealed is therefore probably the correct one.

The figure accompanying this description shews the relative size of the fore-limb and the scapula with the coracoid. The limb is here shewn in lateral aspect, in a natural position below its articulation with the scapula, and with the digits only slightly curved.

Attention is drawn to the extreme shortness of metacarpal II and the elongation of the penultimate phalanx in each digit. A similar lengthening of the corresponding phalanges is seen in the manus of the small Jurassic *Ornitholestes hermanni*, Osborn,* in which also there are two digits, a vestigial metacarpal IV, and an enlarged ungual phalanx in digit II.

The estimated length of this dinosaur, which, for the present, is referred to the genus Deinodon, is between twenty-eight and thirty feet. Why its front limbs were so diminutive is difficult to explain. That they were of much use in feeding is improbable.

The discoverer of this splendid specimen was Charles Sternberg, Jr., who was one of the vertebrate palæontological field party of 1913.

MEASUREMENTS.	Feet.	Inches.
Length of humerus.		$12\frac{6}{8}$
" " ulna.		$6\frac{1}{2}$
" " radius.		$6\frac{1}{8}$
" " metacarpal II.		$1\frac{7}{8}$

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* Bull. Am. Mus. Nat. Hist., New York, vol. xix, article xii, pp. 459-464, figs. 2 and 3.

MEASUREMENTS. [Continued]	Feet.	Inches.
Length of metacarpal III		$3\frac{7}{8}$
" " " IV		$2\frac{1}{2}$
" " first phalanx of digit II		$3\frac{7}{8}$
" " terminal " " " "		$3\frac{1}{8}$
" " first " " " III		$2\frac{1}{8}$
" " second " " " "		$3\frac{1}{8}$
" " scapula and coracoid together	3	6
Carpal bone with diameter of		$0\frac{7}{8}$
" " " length "		0[illegible]
Two carpal bones with length each of		$0\frac{5}{8}$

PROTOROSAURUS, gen. nov.

Skull large, broadly triangular in superior aspect, with an abbreviated facial portion and a greatly expanded posterior crest ending squarely behind. Coalesced parietals forming a slender frame-work enclosing large subtriangular fontanelles. Squamosals very long and narrow with a scalloped free border. Epoccipitals present. Supraorbital horn-core small, upright. Orbit small. Supratemporal fossæ not greatly developed. Body covered with non-imbricating plate-like, and tubercle-like scales.

This genus is proposed for the reception of the Belly River Cretaceous ceratopsian species originally described by the writer under the name *Monoclonius belli.*

The species was established in 1902* on a large portion of the coalesced parietals discovered by the writer in 1898 in the Belly River formation on Red Deer river, Alberta, below the mouth of Berry creek (Steveville). In the original description the opinion was expressed that the species represented was "probably ancestral to such later forms as *Torosaurus latus* and *T. gladius* of Marsh, from the Laramie of Wyoming." This belief is strengthened by the discovery during the past summer of a skull, with most of the skeleton, of one individual of this species at the type locality. It is now evident that this Belly River form is generically distinct from both Monoclonius, Cope and Ceratops, Marsh, and that its affinites are with Torosaurus, Marsh, to which it apparently leads in a direct line of descent, and from which it differs by well-marked primitive characters

The characters in Protorosaurus which are regarded as primitive in comparison with Torosaurus are its smaller size, the greater relative length of the skull in front of the orbits, the retention of the scalloped free margin in the squamosal, the greater size of the intraparietal fontanelles which have been reduced in Torosaurus by a broadening of the parietal framework, and the much smaller supraorbital horn-cores which are upright instead of being curved forward.

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* Contributions to Canadian Palæontology, vol. iii (quarto), pl. ii, On vertebrata of the mid-cretaceous of the North-west Territory, 2. New genera and species from the Belly River series, p 66, pl. xx, figs 1 and 2.

The finding of the skull of *Protorosaurus belli* completely does away with any idea as to the specific identity of this species with *Mono clonius canadensis*, Lambe, also from the Belly River Cretaceous of Alberta; a consideration at no time entertained by the writer.

With the skeleton of *P. belli* were found well preserved impressions of the integument.* These impressions seem to refute the hitherto generally accepted idea of the presence in the Ceratopsia of bony scutes such as are found in the Stegosauridæ, notably in *Euoplocephalus* (*Stereocephalus*) *tutus*, Lambe, from the Belly River formation. We now know that the integument of *P. belli* was of the same general character as that of the trachodonts, and probably the other horned dinosaurs were similarly covered.

The natural impressions of the integument of *P. belli* consist of smooth polygonal surfaces, ranging in diameter from about one-eighth of an inch up to one inch and one-eighth, indicative of the presence in the living animal of non-imbricating scales or plates, fitting closely to each other, and having generally five or six sides. The plates themselves are not preserved but they have impressed their shape in the sandstone (moulds) from which natural casts have been made by the matrix replacing the plates.

The larger plates have a flat or very slightly convex surface and are defined by a circumscribing groove. The smaller sized plates have the form of low or flattened tubercles and were apparently present over a large area. The larger plates are assembled and increase in size toward a somewhat central one which is the largest, and which may be polygonal or rounded in outline. There is evidence of polygonal plates at least two inches in diameter and of others with a nearly circular outline equally large. In the larger sized plates the sunken peripheral margin has a crinkled appearance due to the presence of short grooves at right angles to, and ending at the edge of the plate.

The impressions of the plates so far seen are mostly from the trunk region in the neighbourhood of the shoulder where the increase in size seems to be from below upward. Other impressions from lower down on the body are of the small tubercles apparently indicating an absence here of the larger sizes of plates.

The collection of 1913 from the Belly River formation on Red Deer river also includes natural moulds and casts of large areas of the skin of the species described by the writer in 1902,* under the name *Trachodon marginatus*. A figure of the surface markings of a small portion of the skin of this species accompanied the writer's original description, but the new material brings to light with wonderful distinctness features additional to those already known, and discloses a tubercular pattern of surface ornamentation as unique as it is unexpected.

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* This specimen, with skin impressions, was discovered by Mr. Charles H. Sternberg, in charge of the Geological Survey vertebrate palæontological expedition of 1913.

Trachodon marginatus was founded on an admirably preserved maxilla and lower mandibular ramus, with teeth in place having a definite marginal sculpture, and on many bones of one individual with skin impressions. Provisionallyassigned to this species were slender ischia ending distally in a foot-shaped expansion, a pubic bone, a femur, tibiæ and other elements of the skeleton. That the association of the footed-ischium with *T. marginatus* was correct is borne out by the remains of two individuals** collected last summer with which the maxillæ and lower jaw are present in one, and the ischia in both. A comparison of the new material with that on which the species was based entirely establishes the correctness of the writer's original description. It is with one of these specimens of last summer's collection that the skin impressions are preserved. These impressions are from the side in the trunk region, and along the tail. In the former, depressed conical plates or scales, having an oval basal outline, occur at intervals with much smaller, polygonal, tubercle-like, non-imbricating plates filling the interspaces. The conical plates strongly resemble limpets in shape, and are about twice their diameter apart. They reach a size of about one and a half inches in length and one and a quarter inches in breadth, with a height of about five-sixteenths of an inch. The comparatively small, intervening plates resemble the smaller sized plates of *Protorosaurus belli*, and of *Trachodon annectens*, Marsh, as described by Osborn.‡ They range in diameter from about one-eighth up to two-eighths of an inch, an increase in size occurring toward the conical plates round which the largest ones form a ring. A marked feature of the conical scales is a radial crinkling which is most pronounced at the basal circumference and extends about half way up the sloping surface.

In the tail the same scale pattern is continued but in a less striking manner, its component parts being reduced in size. The conical plates are more nearly circular in basal outline, with a diameter of about half an inch, and a proportionately lower relief. They are relatively farther apart than those of the trunk, being about four to six times their diameter distant from each other. The polygonal ones have an average diameter of about three-sixteenths of an inch, and, as in the trunk, a slight increase in size is observed in those near the conical plates. Along the side of the body the conical plates have their long diameter in a fore and aft direction.

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* Op. cit., p. 71, pls. iii-x. **Expedition of 1913; found by Mr. Charles H. Sternberg.

‡ Memoirs of Amer. Mus. Nat. Hist., new series, vol. i, pl. ii; Integument of the Iguanodont dinosaur *Trachodon*, pls. vi and vii.

The scale patterns above described are probably distinctive of the species, and will no doubt, with the known ones of other Cretaceous herbivorous dinosaurs, prove a reliable aid in specific determination.

The skin impression of a third Cretaceous herbivorous dinosaur, shewn in plate XVII accompanying this paper, is part of a large area of epidermal markings, from above the hip, preserved with an almost complete skeleton of a trachodont obtained by the vertebrate palæontological expedition of 1912 from the Edmonton formation on Red Deer river, and now exhibited as a panel mount in the museum of the Geological Survey. This specimen was thought to be referable to *Trachodon marginatus* of the Belly River formation and was provisionally assigned to that species. As the scale pattern of the integument of *T. marginatus* is now definitely known and proves to be quite different from that of the Edmonton specimen it is clear that the latter is not referable..to *T. marginatus*. It is now known with certainty that *T. marginatus* had a footed-ischium but unfortunately in the Edmonton specimen the distal ends of the ischia are not preserved.

The epidermal markings found with the Edmonton specimen and already briefly described in a paper* by the writer, are natural moulds and casts of non-imbricating scales of which some are larger than others. The larger ones are flat or slightly convex, polygonal in outline, and average about a quarter of an inch in diameter; they are aggregated in irregularly oval clusters from two to three inches in greater diameter, and about three-quarters of an inch apart. Between the clusters are minute, tubercle-like scales averaging about one-tenth of an inch in diameter and forming the general ground-work of the pattern.

This scale pattern is of the same general character as that of *Trachodon annectens* (Marsh), as described and figured by Osborn‡ in a specimen from upper Cretaceous beds in Converse county, Wyoming, U.S.A., but is more pronounced; the oval clusters of plate-like scales are larger, and the scales composing them have a greater average diameter. The small sized tubercle-like scales are much the same as in the Wyoming specimen.

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* The Ottawa Naturalist, May, 1913, The manus in a specimen of Trachodon from the Edmonton formation of Alberta.

‡ Op. cit.

EXPLANATION OF PLATES.

PLATE XIII.—Right fore-limb of carnivorous dinosaur; one-eighth the natural size.

PLATE XIV.—Fig. 1. Natural cast of integument of *Protorosaurus belli* shewing large, polygonal, plate-like scales; natural size.

Fig. 2. Cast of large scale with a rounded outline; natural size.

Fig. 3. Cast of large scale probably polygonal in outline; natural size.

Fig. 4. Cast shewing transition from small tubercle-like scales to larger polygonal ones; natural size.

Fig. 5. Cast of polygonal scales; natural size.

Fig. 6. Mould of the same; natural size.

PLATE XV.—Natural mould of integument of *Trachodon marginatus* from the side of the body; natural size.

PLATE XVI.—Natural mould of integument of the same individual from the side of the tail; natural size.

PLATE XVII.—Skin impression (mould) of trachodon from the Edmonton formation; natural size.

MEETING OF THE ENTOMOLOGICAL BRANCH.

Held at the home of Mr. Arthur Gibson, January 8th, 1913. Present: Rev. Dr. Fyles, W. H. Harrington, J. M. Swaine, V. Kitto, Bro. Germain, Bro. Martial, G. Beaulieu, N. Criddle, A. Halkett, F. W. L. Sladen, J. W. Baldwin, J. I. Beaulne, J. R. Fryer, E. H. Strickland and A. Gibson.

Dr. Fyles gave a charming account of his first visit to Gomin Swamp (near Quebec City), over fifty years ago, in search of the interesting butterfly *Œneis jutta*, a swamp-loving species. He also described the life-history of the insect. In a small case specimens of the adults were exhibited as well as specimens of *Œneis macounii* and *O. katahdin*. This latter is given varietal rank in Dyar's List of N. A. Lepidoptera. Attention was called to the large number of forms placed in this list under *norna*. Mr. Gibson spoke of his first experience with *O. jutta* at the Mer Bleue, near Ottawa, mentioning the habit of the butterfly of resting on dead branches and trunks of trees, where it is protected considerably owing to the resemblance of the under side of its wings to the bark.

By holding plates XV, XVI and XVII upside down the concave surfaces appear convex, giving a vivid representation of the scale pattern as it was in the living animal.

Mr. Harrington showed twigs of oak from Meach Lake, Que., from which he had reared the cerambycid, *Elaphidion parallelum*. The larva tunnels the twigs for several inches and pupates therein, finally emerging through the base of a broken twig. This beetle is a close relative of the well known Oak Twig Pruner, *Elaphidion villosum*, which was quite injurious to oaks on the St. Lawrence Island Parks in 1912 and 1913. The well known habit of these larvæ in girdling the twigs, causing them to drop and owing to which injury they are broken during wind storms, was discussed.

Mr. Swaine exhibited specimens and work of Ambrosia-beetles collected by him the past summer in British Columbia, and briefly discussed the habits of the genus *Gnathotrichus*, and of a new species of the genus *Platypus* from the West Coast. Tunnels of *G. sulcatus* Lec. were shown from Western Hemlock. Their black tunnels, about the size of a pencil lead, penetrate the wood for about six inches, and give off lateral branches parallel with the wood surface. Along the sides of the tunnels egg-niches are cut, in which eggs are laid. The grubs enlarge the niches to a length slightly greater than their own when mature, and pupate therein with the head towards the tunnel. These short larval tunnels are known as larval or pupal cradles. After transformation the young adults enter the egg-tunnel, and after remaining a longer or shorter time in the tunnels or in the cradles, they emerge in early summer through the entrance tunnel cut by the parent beetles to attack fresh logs and stumps or dying trees. The chief food of the larvæ, and an important food of the adults, is a species of fungus which grows in a dense glistening layer on the tunnel walls. Mr. Swaine has recently worked out the life-history of several of these interesting and little known fungi. The fungus is carried by the beetles to new tunnels and rapidly spreads over the fresh wood of the tunnel sides and upon the walls of the larval cradles. The fungus stains the walls of the tunnels black for several millimetres. The habits of the species of *Platypus* are somewhat similar to the above, but the eggs are deposited free in the tunnels.

Mr. Criddle spoke upon certain phases of his investigations into the habits and life-histories of the various species of June Beetles (*Lachnosterna*) which he had been studying as a field officer of the Division of Entomology. He related how the different species were often quite local in distribution owing to each having preferences in matters of soil and moisture as breeding places. Thus, *L. dubia* was taken in all its stages within an area of a few feet and the duration of its life cycle probably discovered in a single day. He also spoke upon the hibernating habits of the larvæ, instancing how some species remained within a foot or two of the surface while one, viz., *L. rugosa*, was found at depths varying from 47 to 91 inches. Mention was also made of the remarkable manner in which skunks sought out the larvæ for food, thus doing much good. An interesting discussion followed on the habits and food of skunks in general.

Mr. Sladen exhibited twelve species of wasps of the genus *Odynerus* taken in the Ottawa district and described the habits of *O. spinipes*, a European species. It provisions its cell with small green caterpillars. The egg is attached to the roof of the cell by a thread so that it is not disturbed by the wriggling victims. He also showed a parasitic bee, *Coelioxys rufitarsus*, with its host, *Megachile latimanus*, a leaf-cutter bee, and explained how, according to Graenicher, the parasite pierces the leaves lining the cell of the *Megachile* by means of its conical sharp-pointed abdomen, and inserts its egg. The *Coelioxys* larva is at first provided with enormous mandibles with which it kills the *Megachile* larva, but after the first moult the mandibles are of the small size found in other bee larvæ, and thence forward it feeds entirely on the pollen that the *Megachile* has provided. Mr. Harrington remarked that in Ottawa, as in England, *Megachile* is very fond of cutting circles out of the leaves of the garden rose to line its cells. It also often chooses maple leaves. He had noticed that if the surroundings of a solitary bee's or wasp's nest were disarranged the insect could not find its way in. It seemed to have committed to memory every detail; this was done by circling round the spot many times. Mr. Sladen said that queen bumble bees he had got to lay eggs in captivity, when allowed to fly, never returned, though they marked the spot carefully, and he believed they lost the power to learn the position of their nest as soon as they began to lay.

Mr. Strickland spoke upon the subject of parasites in *Simulium* larvæ. After briefly describing the acquatic habits and structure of the early stages of the Black fly, and pointing out the interest that is centred upon this fly as the possible carrier of the human disease Pellagra, he gave an account of the parasites he had found infecting their larvæ in the streams in the vicinity of Boston, U.S. These consisted of a worm and various protozoa, all of which were fatal to their larval host, and occurred in sufficient numbers to be of considerable economic value. The worm is a species of *Mermis* that inhabits the abdominal region of the body cavity, where it lives coiled up and almost motionless absorbing the body fluids of its host, till the latter is full grown. It then ruptures the skin and escapes, killing the larva in the process. When the worm only is present it is 3 cm. long, or about three times the length of its host. As many as 12 were found in one larva, in which case they all remained small. The most interesting effect of this parasite is that it stops all growth of the external adult organs (legs, wings, etc.) in the larva. In a normal larva these organs are well developed at the time of maturity and are readily seen through the transparent skin of the thoracic region. The parasitised larva grows to an abnormal size, as if at the expense of these organs. The protozoan parasites, with the exception of one, belong to the genus *Glugea* and are closely related to the Pébrine disease of silkworms. Several species were present in different larvæ. All of them form large masses of parasitic material in the body cavity, which, at maturity, are resolved into innumerable minute spores, which spread the disease in the water upon the death of the host. The other protozoan proved to be a *Gregarine* that formed a vast number of small cysts in the body cavity, from which, later, motile "spores" escaped.

Mr. Beaulieu, who is working on a monograph of Canadian Elateridæ, showed a collection in which there were representatives of the 25 genera found in our fauna. He also exhibited a specimen each of two new species, *Limonius venablesi* Wck., and *Corymbitis weidtii* Ang. The following figures, showing the distribution of the species of this interesting family, were given: Known species in the world fauna, about 5,500; American species, about 2,260; American species north of Mexico, about 500; Canadian species, about 190. Described genera, world fauna, 285; American genera, 129; American genera north of Mexico, 47; Canadian genera, 25.

Mr. Gibson exhibited his collection of Canadian arctiid moths of the genus *Apantesis*. These were shown in five large cases. Attention was directed to certain of the species which had been reared from the egg. In some of the series larvæ in all stages were present, and with many species adult larvæ and pupae. These moths, known popularly as "tiger moths," are very beautiful insects. The larvæ are clothed with dense clusters of hairs, usually black or reddish. In spring they may often be found under pieces of board, etc., along railway tracks. Species which occur in the Ottawa district are *virgo*, *virguncula*, *parthenice*, *arge*, *celia*, *figurata*, *nais* and *vittata*.

Other interesting exhibits which were brought to the meeting were: by Bro German, specimens of *Saperda concolor* and its work, and a hymenopterous parasite reared therefrom; also a rare beetle, *Carabus nemoralis*, taken at Montreal. This is supposed to be a European species, but Mr. Beaulieu stated that Dr. Lapouge, the French authority in the genus *Carabus*, considered that this was not the true *nemoralis*; by Mr. Kitto, a collection of Cerambycidæ and Elateridæ, taken in the Ottawa district, some interesting species were represented; by Mr.

Halkett, ants' nests from Germany, specimens of *Calosoma sycophanta*, and the Blind Worm, *Anguis fragilis*, also from Europe.
A. G.

NOTE ON THE AMERICAN MAGPIE (*Pica pica hudsonica*).

This bird appears to be rare north of the 53rd degree of latitude in central Alberta, and even 50 miles south of that line it is not by any means common. I have never seen it north of Camrose, nor does Mr. Spreadborough mention having seen it in his travels north from Edmonton down the Athabasca or McKenzie Rivers. On the west side of the mountains along the coast it is found as far north as the Arctic Circle. During the past twenty-two years I have only seen it three times, as follows: one near the Big Bend of the Red Deer River in December, 1894; two near Wolf Creek, north of Lacombe, in October, 1912, and one on September 28th, 1913, six miles west of Camrose, near Bittern Lake. I have known of several colonies breeding on the Knee Hill Creek, about 30 miles east of Olds, and I believe this to be the northern limit for nesting.

F. L. FARLEY, CAMROSE, ALTA.

THE FOLLOWING BOOKS, WHICH WILL BE OF INTEREST TO MANY MEMBERS OF THE CLUB, HAVE RECENTLY BEEN PLACED ON THE SHELVES OF THE CARNEGIE PUBLIC LIBRARY.

Earth Features and Their Meaning, by W. H. Hobbs. An introduction to Geology. (Ample treatment, of interest to those who care to be able to read, in the landscape, the history of the vicissitudes which the region under observation has undergone).

Influences of Geographic Environment, by E. C. Semple. (Amplified presentation of Ratzel's theories that geographic conditions are the chief factor in the physical, intellectual and social development of man."

Climate—Considered Especially in Relation to Man, by R. D. Ward.

The Wanderings of Animals, by Hans Gadow. (Sketch of the distribution of the animals over the earth's surface. Cambridge Manual Series).

The Earth—Its Shape, Size, Weight and Spin, by J. H. Poynting.

The Non-Metallic Minerals, Their Occurrence and Uses, by G. P. Merrill. (Important work on minerals of value other than as ores of metals).

Natural Philosophy, by W. Ostwald. (Brief survey of the sciences, their general import and unification of present knowledge concerning them. A general introduction to science and to one view of philosophy).

The Ways of Planets, by M. E. Martin. (Discusses in a simple, informal manner the origin, position and characteristics of the various planets).

The Solar System—A Study of Recent Observations, by C. L, Poor. ("Not too obstruse, thoroughly entertaining and timely"—Nation).

Darwinism and Human Life, by J. A. Thomson. ("Authoritative, interesting and easily comprehended statement of the history and present status of evolution"—A.L.A.)

The Origin and Nature of Life, by B. Moore. (Home University Series. Clear and concise statement of the problem from the chemical point of view"—A.L.A.)

College Zoology, by R. W. Hegner. (An excellent text designed for beginning college students).

Agriculture, by W. Somerville. (Makes the results of laboratory work at the university accessible to the practical farmer).

MEETINGS OF THE BOTANICAL BRANCH.

December 6th, 1913, at the home of Mr. R. B. Whyte, the following members being present: R. B. Whyte, Dr. M. O. Malte, G. H. Clark, L. H. Newman, J. M. Macoun, N. Criddle, W. T. Macoun, C. J. Tulley, A. E. Attwood and J. R. Fryer.

In response to the call for botanical specimens from members Mr. Criddle exhibited an interesting specimen of the genus *Neslia* (Ball Mustard) and one of the genus *Setaria* (Foxtail Grass), on the latter of which was an abnormal foliaceous development of the bracts. Mr. Newman exhibited a sample of wheat which took the world's prize at Tulsa, Oklahoma, in October, 1913. Mr. W. T. Macoun showed a couple of Peli nuts which were characterized by an exceedingly hard shell. They were somewhat larger than ordinary nutmegs and more angular in shape.

Dr. M. O. Malte spoke on "Some Results of the Summer's Work in Botany" and dealt especially with the species *Mentha*, *Viola* and *Juncus*. Specimens of true *Mentha arvensis* L., collected by him in Nova Scotia, were shown and the statement made that on account of the characters of the calyx the true *M. arvensis* L. can scarcely be grouped with other Canadian species of *Mentha* now regarded as varieties of it. Dr. Malte was of the opinion that the Menthas which now are called *M. arvensis* L., var. *canadensis* (L), Briquet, and var. *lanata* Piper, are specifically distinct from *M. arvensis*, and furthermore, that the difference between *canadensis* and *lanata* are so great that both deserve specific rank. The latter supposition was borne out by Mr. J. M. Macoun, who stated that in British Columbia, where both are frequently growing together, the differentiating characters seem to be perfectly constant.

Dr. Malte also exhibited specimens of *Viola rostrata* Pursh, from Chats Falls, Ont., collected by Mr. J. M. Macoun and himself last spring, and explained that this was the second time the species had been found in the Ottawa district. It was growing with *V. conspersa* Rchb. Perfectly typical hybrids representing the combination *V. conspersa* x *rostrata*, found among the parents, were shown. They were intermediate in all respects as to morphological characters and had over 90% of the pollen undeveloped and unfit for fertilization. The speaker further exhibited a number of species of *Juncus* primarily with the object of demonstrating the ease with which many plant species which to the unexperienced student may seem difficult and puzzling, can be identified. With the use of a Zeiss binocular microscope, kindly placed at the Club's disposal by the Topley Company, characters on the seed only, sufficient for the correct identification of such species as *J. articulatus* L. *J. brevicaudatus* (Engelm) Fernald, *J. canadensis* J. Gay, etc., were explained. In this connection a completely sterile form, collected at Bridgetown, N.S., was exhibited. This form was found to represent the combination *J. articulatus* x *canadensis*.

Mr. Uhlemann, a visitor, spoke briefly on the Zeiss binocular microscope, stating that this instrument is probably one of the best of its kind in the world.

J. R. F.

December 20th, 1913, at the home of Mr. J. M. Macoun, the following members being present: W. T. Macoun, L. H. Newman, Geo. H. Clark, N. Criddle, Mr. Honeyman, Dr. Malte, Dr. Blackadar, A. Eastham, T. W. Dwight, A. E. Attwood, R. B. Whyte, J. M. Macoun, C. J. Tulley and J. R. Fryer.

Mr. C. J. Tulley and Dr. Malte were the speakers for the evening. Mr. Tulley first reviewed the evolutionary steps in reproductive processes in some of the lower plant forms. Commencing with the unicellular plant forms, the speaker briefly compared their cytological features with those of the simplest animal form, Amoeba, and explained that the reproductive method in unicellular plants is one of continuous cell multiplication, one individual becoming two by cell division. This method of reproduction was designated *Cell Division*, as distinguished from the other two methods, *Asexual* and *Sexual*. In plants somewhat higher than the simplest of unicellular forms the reproductive method is slightly different. The products of cell division are dissimilar, certain daughter cells being specialized for reproductive purposes. These reproductive cells are called *spores*, and in cases where they are similar one to the others, the method of reproduction is known as the *Asexual method*. In forms still higher, some algae, for example, another method of reproduction is suggested. The spores produced are similar in appearance, but do not develop directly into new individuals. They first unite in pairs, forming in each case of union, a *zygote*, which develops into an adult individual. This method of reproduction is known as the *Sexual method*, and where the uniting cells are similar the fusing process is known as *Conjugation* or *Isogamy*. In other forms the fusing cells are dissimilar, in which case the type of sexual reproduction employed is termed *Heterogamy*. In such cases the gametangia (organs bearing the gametes) are also differentiated.

Mr. Tully referred especially to *Ulothrix*, an organism which bears two kinds of spores. One kind has two cilia on each spore, the other kind has four. The smaller two-ciliated spores unite in pairs, resulting in the development of a new filament. The speaker believed these similar gametes to be the beginning of the sexes.

These methods were illustrated by microscopic specimens, those of Spirogyra and Vaucheria being especially fine.

Mr. Tully then briefly described a method of preparing microscopic sections. Hard stems are first soaked in a mixture of glycerine, plus 95 per cent. alcohol, to soften the tissue for sectioning; tender stems are soaked in water and softer plant tissue, such as leaves, in a mixture of chromic acid, plus glacial acetic acid, plus water. The specimen is then cut with a microtome and the sections dropped into a little wire gauze basket, which may be immersed with the sections into the stain. The stains used are *methyl violet*, which brings out the ligneous tissues, and *congo red*, which colors the softer tissues. *Eosin* may also be used for the softer parts. After staining the sections are washed in water and then in alcohol. This method was beautifully illustrated by some sections of stems taken from Mr. Tulley's own collection.

Dr. Malte then said a few words on fixing and staining vegetable tissue. He referred to the fact that nuclei in life are irregular in shape, having ramifications which extend not only to the cell wall, but pass through it, thus establishing direct communication between the cell and its neighbors. Dr. Malte suggested the possibility of these nuclear ramifications being responsible for the conveyance of stimuli which pass from one tissue to another in the leaf of *Mimosa* (Sensitive Plant) when this leaf responds by its phenomenal movement to the touch of a foreign object. He stated that under the ordinary method of fixing, these ramifications are dissolved by the alcohol and the nucleus is represented in a spherical form quite different from its shape in natural life. To overcome this difficulty and fix nuclei as in their natural state, Dr. Malte gave the following method: Treat the specimen from 10 seconds to 1½ minutes in fumes of *Osmic acid* (10 per cent.); then a few minutes in 10, 20, 30, 40, 50 per cent. alcohol respectively. Keep in 60 per cent, alcohol 24 hours and then proceed to absolute alcohol as usual.,

J. R. F.

January 3rd, 1914, at the home of Mr. G. H. Clark, the following members being present: G. H. Clark, R. B. Whyte, W. T. Macoun, J. M. Macoun, A. Eastham, J. Dickson, E. D. Eddy, H. A. Honeyman, J. H. Grisdale, T. W. Dwight, L. H. Newman, N. Criddle, A. E. Attwood, J. R. Fryer..

Mr. G. H. Clark led in a discussion of the clay belt of New Ontario. A large number of interesting photographs, showing the character of the country along the right of way of the National Transcontinental Railway, which had been made available for the evening by Mr. D. MacPherson, of the National Transcontinental Railway Commission Staff, and also a collection of photographs showing progress in clearing and cropping in the Temiskaming district and north, which had been loaned by G. A. Galbraith, district representative for agriculture of New Liskeard, proved to be of special interest. Mr. Clark, in company with the Director of the Dominion Experimental Farms, spent ten days traversing the clay belt along the new railway lines. Of the 275 miles covered, from Abitibi westward, only 14 per cent. was considered as useless for agriculture. An additional 26 per cent. was relatively flat, covered with black spruce and poorly drained naturally. The balance, 60 per cent., as viewed along the right of way, was rated 21 per cent. excellent, 39 good, from the viewpoint of the settler. Limitations as to kinds of crops, because of the northerly climate, formed a considerable part of the discussion. It was thought that the information at present available was not to be considered reliable, and that as the forest is cleared away the length of the season will be much extended, as was the case in Old Ontario. Particular mention was made of the luxurious growth of grasses and clovers, as seen under agricultural conditions in the few settled localities near Cochrane and south, and around the construction camps to the west.

Mr. Honeyman, who had visited Hearst, in New Ontario, spoke briefly on the climatic conditions of that district, with special reference to late spring and early fall frosts, and listed the following plants which he found growing there: Spruce, balsam, white birch, cedar, poplar, mountain ash, gooseberry, blueberry, dogwood, clintonia, anemone, buttercup, great willow-herb, labrador tea, pitcher plant, yellow pond lily, ferns and botrychium.

Mr. J. M. Macoun exhibited some English walnuts which had been produced by a Canadian grown tree. Members of the Club tested these nuts and found them to differ but little from the regular English walnut.

J. R. F.

BIRD NOTES FROM AWEME, MANITOBA.

An interesting instance of how lack of snow is largely instrumental in retarding the migratory movements of certain birds was brought prominently to our notice during the present winter, the details of which seem worthy of record.

The Lapland Longspur (*Calcarius Lapponicus*) is an early migrant, as well as a late one. In autumn its movements depend largely upon weather conditions, particularly snow, but, as a rule, it leaves us in Manitoba early in November. In 1913, all had left Aweme by November 16th, but soon after that date the weather turned mild again, causing the small amount of snow to vanish, thus exposing many seeds to view. On December 3rd, Longspurs began to arrive from the south in small flocks of from 15 to 20, and by the 17th were on the fields in hundreds, singing and flying about as if it were springtime. They remained common until the 24th, at which date the temperature dropped to 19 below zero, preceded by a light fall of snow, causing many of the birds to depart. A number remained, however, until the end of the year. On January 1st and 2nd, 1914, nearly 3 inches of snow fell, causing the last Longspur to depart.

This, I believe, constitutes a record for lateness of that species in Manitoba; at all events it does so in our parts. It also suggests that snow covering the food supply, possibly supplemented by cold, is the chief factor in driving the species south.

STUART CRIDDLE.

THE OTTAWA NATURALIST

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ON *GRYPOSAURUS NOTABILIS*, A NEW GENUS AND SPECIES OF TRACHODONT DINOSAUR FROM THE BELLY RIVER FORMATION OF ALBERTA, WITH A DESCRIPTION OF THE SKULL OF *CHASMOSAURUS BELLI*.*

By Lawrence M. Lambe, F.G.S., F.R.S.C., F.G.S.A.,
Vertebrate Palæontologist to the Geological Survey, Canada.

In two papers lately published the writer has described some of the dinosaurian material included in the 1913 collection, made by the Geological Survey's vertebrate palæontological party in the Belly River formation on Red Deer river, Alberta, under Mr. Charles H. Sternberg.

The present paper is descriptive of a skull representing a new genus and species of trachodont, and of that of *Chasmosaurus belli*, both forming part of last summer's collection.

The skull of the trachodont is remarkable for its splendid state of preservation. The elements composing it are singularly free from breaks and displacement, there is little or no distortion, and the specimen is as close an approach to perfection as can be expected in a fossil vertebrate of large size.

With the skull were found about twenty feet of the vertebral column, most of the pectoral arch, about half of the ribs, the pelvic arch, one hind limb with part of the foot, and impressions of the skin from between the femur and the base of the tail. The discoverer of these remains was George F. Sternberg, who has also prepared the skull as shown in side view, on plate XVIII.

For the genus and species represented the name *Gryposaurus notabilis* is proposed, the generic term having reference to one of the most striking features of the skull, viz., the prominence attained by the upper marginal curve of the nasal bones.

The genus may be defined as follows:—Skull large, narrow and very deep, with highly arched nasals. The lower anterior border of the premaxillæ expanded laterally. Orbit much smaller than the lateral temporal fossa. Quadrate high, partially separated from the jugal by a small quadrato-jugal. Mandible robust. Predentary expanded laterally and deflected in its hinder half, and posteriorly bifurcated below at the midline. Neural spines of the anterior dorsal vertebræ long. Ischia not expanded distally. Body covered with small, polygonal, non-imbricating, tuberculate scales of rather uniform size.

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*Communicated by permission of the Director of the Geological Survey.

In no other member of the Trachodontidæ is the skull so deep anteriorly as in *Gryposaurus notabilis*. The nasals rise to an extraordinary height a short distance in advance of the orbits. The top of the curve of the nasals is as high as the highest point of the back of the skull, viz., the summit of the squamosal behind the supratemporal fossa. The depth of the head at the apex of the nasal bones is equal to about half the maximum length of the skull.

For the present, the characters of the species will be taken for the most part from the skull.

Viewed from the side, the superior outline of the head is most depressed above the front border of the orbit, rising abruptly forward by a short ascent to the summit of the nasals, whence it descends rapidly to the anterior end of the premaxilla in a long curve whose general convexity is broken by a slight dip at midlength. From above the orbit the outline slopes gradually upward to attain the highest posterior point of the dorsal surface of the head a little in advance of the upper end of the quadrate.

Seen from above, the broadest part of the head is along the surface of the jugal beneath the lateral temporal fossa, whence it contracts upward to the dorsal surface and forward to a point beneath the hinder end of the nasal opening, to expand again to a moderate extent in the lower premaxillary border.

In the dorsal surface of the skull there is a slight diminution in breadth from behind the orbits backward, a somewhat equal contraction forward above the orbits, continued in a much greater degree, in the front half of the skull, by the narrow median elevation of the nasals and premaxillæ.

The sutures in this skull are so distinct that the position, shape and connections of the various elements composing it can be readily understood by reference to its photographic representation in lateral aspect in plate XVIII.

The narial opening is extremely long and narrow. It is enclosed behind and mostly above by the nasal, and in front, and for the greater part below, by the premaxilla.

The orbital opening is higher than wide, somewhat quadrangular in outline, and narrower below than above. The upper rim is formed equally by the prefrontal and postfrontal, and has a rugose surface. In the rim between these bones is what appears to be a small separate bone, which is regarded as a supraorbital. The slender postorbital bar is formed by a process sent down from the postfrontal to meet one rising from the jugal. The opening is bounded beneath by the jugal, and in front by the prefontal, lachrymal and jugal. In the upper anterior part of the opening there is a conspicuous emargination of the rim bounded in front and above by the prefontal and below by the lachrymal which sends up a short, stout process from its posterior border behind the emargination. What appears to be the opening of the lachrymal canal is here visible within the indentation.

The lateral temporal fossa is more than twice as high as wide and is narrowly rounded at its front lower termination. It is bounded in its lower half by the jugal, and in its upper half by the postfrontal anteriorly, by the postfrontal and squamosal above and by the squamosal and quadrate posteriorly. The jugal connects with the quadrate for some distance above the upper end of the quadrato-jugal.

Anteriorly, the jugal effects a strong union with the maxilla below and the lachrymal above. The lachrymal meets the maxilla below in advance of its union with the jugal and connects with the nasal for a short distance, separating the prefontal from the long, backwardly directed lower limb of the premaxilla.

The nasal extends back as far as the posterior end of the postfrontal and meets the frontal in a coarsely dentate, transverse suture. The frontal is about as broad as long and does not reach the orbital rim. Antero-laterally this bone connects with the postfrontal and supraorbital, postero-laterally it is met by the postfrontal and behind by the parietal. The naso-frontal surface between the eyes is flat and at a slightly lowel lever than the upper orbital rims.

The supratemporal fossa is angularly oval, with the greater diameter fore and aft. It is enclosed in front about equally by the parietal and postfrontal, and on the outside by the postfrontal and squamosal. The frontal does not quite reach the anterior margin of the fossa. The squamosal passes inward behind the opening to meet the parietal, but to what extent the latter bone contributes to the formation of the posterior border is not known, as the position of the squamoso-parietal suture has not yet been determined. The coalesced parietals form a narrow median bar, separating the two openings.

Viewing the skull from the side, the thin edge of the angular is visible for a short distance beneath the posterior end of the dentary, and the articular appears to a limited extent at the extreme end of the mandible above the surangular. This last bone, which supplies the greater part of the cotylus for the articulation of the quadrate, is stout and ascends in front against the back surface of the coronoid process.

The teeth are of the usual trachodont type and are in from two to three rows in the grinding surface of the lower jaw. A satisfactory examination of the inner enamelled surface of the lower teeth has not been possible, but in two of the teeth seen from the inner side, the margin appears to be smooth, or nearly so.

The edentulous part of the dentary is short and decurved and is covered in front for a little more than half of its length by the predentary.

The front margin of the premaxillæ, for a distance of 2¼ inches on each side of their median sutural union, is notched in a regular manner. On each side of the dentate edge the margin curves concavely upward and then merges into the extensive, depressed, lateral expansion.

Superiorly, the predentary conforms to the shape of the premaxillaries. Its antero-lateral border rises on each side of a sunken median portion which would receive the notched end of the premaxillaries if the jaws were brought together. Postero-laterally, the predentary expands outward, producing a surface which is concave above and conforms to the shape of the lower surface of the lateral premaxillary expansion. This concave surface terminates outwardly behind in a short pointed process. Antero-laterally, the bone is excavated beneath the border of the upper surface. The retreating lower median surface ends posteriorly in two processes, one on each side of the symphysis, the anterior end of the dentaries being excavated to receive them. These processes are longer than broad and thin vertically. The predentary is one-third the length of the dentary and one-fourth that of the complete lower jaw.

The skin impressions found with the skeleton to which this skull belongs are natural moulds and casts from the hinder part of the body between the femur and the base of the tail. The impressions are of non-imbricating, polygonal scales, smooth and convex on the upper surface, and varying in diameter from ⅛ up to ⅜ of an inch, with an average breadth of about $\frac{3}{16}$ of an inch. In the considerable integumental area revealed, the scales vary in size between the above limits without any definite pattern arrangement.

It may be found by further study and comparison that the Belly River species *Trachodon selwyni*, established by the writer in 1902,* principally on the evidence of teeth, is the same as

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*Contributions to Canadian Palæontololgy, vol III (quarto), pt. II.

Gryposaurus notabilis, in which case the species would be known as *Gryposaurus selwyni*.

MEASUREMENTS.	Feet.	Inches.
Height of head from lower edge of dentary to highest point of nasal.	1	7½
Height of same from lower edge of surangular to highest point of squamosal.	1	8
Length of same from anterior end of premaxilla to posterior edge of squamosal.	3	3
Breadth between upper rim of orbits.		9⅜
Breadth between expanded lower anterior border of premaxillæ.		9½
Length of lower jaw, including predentary.	2	3¼
Depth of lower jaw at midlength from outer alveolar border to lower edge of dentary.		5½
Height of quadrate.	1	4⅝
Length of dental grinding surface of lower jaw in advance of the anterior margin of the coronoid process.	1	0
Breadth of same at midlength.		1⅜
Length of supratemporal fossa.		6
Width of same.		4
Height (oblique) of lateral temporal fossa.		11
Width (horizontal) of same at midheight.		5½
Height (oblique) of orbital opening.		8¼
Width (horizontal) of same.		5
Length of nasal opening.	1	0½
Width of same at midlength.		2½
Greatest length of premaxilla from front margin to termination above lachrymal.	1	9⅛
Greatest length of predentary.		8
Length of nasal, in a straight line.	1	7¼
Length of frontal at midline of head.		3¼
Max. breadth of same.		4¼
Length of coalesced parietals (approx.).		7¼

Last summer Mr. Sternberg's party on Red Deer river was fortunate in discovering also a fairly complete skeleton with the skull, including skin impressions, of *Chasmosaurus belli*, a species founded by the writer in 1902,* on part of the coalesced parietals, and at that time assigned by him to the genus Monoclonius. The characters of the skull have revealed a new generic type, for which the name Protorosaurus** has lately been proposed.***

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*Contributions to Canadian Palæontology, vol. III (quarto), pt. II

**The Ottawa Naturalist, vol. XXVII, No. 10, January, 1914

***See foot-note, p. 155

The lower surface of the skull has not yet been freed from the matrix, and the remainder of the skeleton is also in the state in which it was brought from the field and awaits description, but the skin impressions found with the remains of this individual have been described and figured by the writer in the paper above mentioned, in which the genus Chasmosaurus is defined.

When found, the front part of the head above and in advance of the midlength of the maxillaries had gone to pieces through weathering, as had also the left side of the face as far back as the outer margin of the squamosal. The plane of weathering had not reached the rami of the lower jaw, which are present, but the predentary is missing. The large squamoso-parietal frill is in a particularly excellent state of preservation. On the right side the orbit and jugal are intact, and both supraorbital horn-cores are present. This specimen was found with the dorsal surface uppermost, in a bed of clayey sandstone impregnated with iron. It has apparently suffered little distortion. The right jugal is pressed outward to some extent, and the squamosals, particularly toward their outer border, appear to be less inclined downward than they should be. The mandibular rami, as also the right quadrate and quadrato-jugal, were slightly displaced, but without distortion.

The genus Chasmosaurus is regarded as ancestral to Torosaurus of Marsh from the Laramie of Wyoming, U.S.A. Its main characters, as already defined, are as follows:—Skull large, broadly triangular in superior aspect, with a narrow, abbreviated facial portion, and a broad and greatly extended posterior crest ending squarely behind. Coalesced parietals forming a slender framework enclosing large sub-triangular fontanelles. Squamosals very long and narrow with a scalloped free border. Epoccipitals present. Supraorbital horn-cores small, upright. Supratemporal fossæ of moderate size. Postfrontal fontanelle present. Jaws robust. Teeth large, of the ceratopsian type. Body covered with non-imbricating, small plate-like, and smaller tubercle-like scales.

In this skull of *C. belli*, discovered by Mr. Charles H. Sternberg, the length is 1½ times the breadth, the distance forward of the anterior end being given with a fair degree of accuracy by the mandibular rami. The very great size of the crest or neck-frill, as compared with the rest of the head, is one of the most striking features of the skull, the length of the former to that of the latter being in the proportion of about 2½ to 2. The frill is almost square, while the abbreviated facial portion narrows rapidly to the front.

The crest, composed of the coalesced parietals and the squamosals, is remarkably flat; it extends backward and laterally in almost a horizontal plane. Its length is to its breadth in the proportion of about 7 to 8, with the maximum breadth near the posterior border. The parietal portion, which forms more than half of the frill, is broadly triangular in shape with the apex of the triangle in front. The squamosals are narrowly triangular, broadest in front, and extend backward to within a short distance of the crest's postero-lateral angulation.

Within the coalesced parietals are two sub-triangular fontanelles, longer than wide, and narrowing to the front, and so large as to reduce the posterior two-thirds of the parietals to a mere slender framework consisting of a median longitudinal shaft, separating the openings, a transverse posterior bar enclosing them behind, and narrow lateral bands forming their outer margins.

There are seven low, sub-conical epoccipitals on the lateral free border of the right squamosal, eight apparently on the left, and one, with a greater proportionate height, at each side of the parietal portion on its postero-lateral angle. These separate ossifications have a lengthened oval or lenticular basal outline, the greater diameter being fore and aft, and the under surface is excavated. They are in shape similar to the epoccipitals of Triceratops and are applied to and cover the convexities of the sinuous margin of the frill in a like manner. Of the series the parietal one is the largest and there is a gradual diminution in size forward. Of the five horned dinosaurs known from the Belly River formation of Alberta, the present species and *Centrosaurus apertus* only have epoccipitals.

The parietals in advance of the fontanelles form a broad surface, flat throughout, except along the median line, where there is a low, rounded ridge which, becoming more pronounced toward the front, terminates anteriorly in a small but well defined upwardly inclined platform which reaches the level of and effects a union with the postfrontals. This platform comes to a sharp edge laterally, where it is undercut by the supratemporal fossæ in a somewhat similar fashion as, but to a less extent than, in Centrosaurus and Styracosaurus.

The longitudinal parietal shaft is oval in cross section with the greater diameter transverse. The posterior transverse bar is bow-shaped, bending slightly backward on each side of the median line and curving rapidly forward at each end to form the postero-lateral angle of the frill. On its upper surface there is a narrow ridge along the curved posterior border, and also a similar thickening on the back margin of each fontanelle. The main upper surface of the bar between the ridges is shallowly excavated.

The squamosal of Chasmosaurus is remarkable for its length, although in comparison with the total length of the head it is shorter than in *Torosaurus gladius*, Marsh of the Laramie. It is transversely concave throughout its length and from near the squamoso-parietal suture slopes downward and outward with a slight upward flare at the free border. Anteriorly, it effects a long sutural junction with the postfrontal and is overlapped by the jugal. It encloses the lateral temporal fossa behind and throws forward a process which forms the greater part of the lower margin of this opening. Its front free border is at right angles to the length of the bone and constitutes the back border of a well defined quadrate notch. Its antero-lateral angle is evenly rounded. Behind its union with the post-frontal its superior surface is broadly rounded transversely and descends rapidly backward to the general level of the parietal portion of the frill. Behind the jugal its surface is almost vertical. In its hinder half the broad front elevation is continued backward as a narrow ridge next to the squamoso-parietal suture. Anteriorly within it overhangs the opening of the supratemporal fossa.

In lateral aspect the jugal is narrow in its lower portion, and evenly rounded at the extremity. Above, it enters into the formation of the lower margin of the orbital rim to some extent. Laterally in front it overlaps the maxilla, and posteriorly above it meets the postfrontal and sends out an extension which forms the front and upper margin of the lateral temporal fossa and overlaps the squamosal for some distance back of this opening. Its posterior border does not assist in enclosing the lateral temporal fossa below, but what appears to be a broken surface on the border beneath the level of the opening suggests a convexity in the outline of the bone at this point. The forwardly directed process from the squamosal beneath the lateral temporal fossa does not reach the jugal and the lower margin of the opening is completed by the quadrato-jugal. Both the quadrate and the quadrato-jugal have been forced out of place, upward, to some extent. A rugose area on the outer posterior surface of the lower end of the jugal suggests that an epijugal may have been present.

The orbit is higher than wide and slightly oblique, with the greater diameter directed downward and forward. The supra-orbital horn-core rises immediately above the eye-opening. It is short and upright, and broadly oval in cross section near the base, with the greater diameter fore and aft. Its basal outer surface is flattened and lies in the same vertical plane as the orbital rim. Behind the horn-core the postfrontal is tumid, and between this convexity and the orbital rim the surface is sunken.

The lachrymal forms the greater part of the front rim of the orbital opening, and meets the jugal below. It is injured anteriorly, and the frontals are not preserved. The postfrontals between the supraorbital horn-cores form a flat surface which slopes downward in front but descends much more rapidly behind. The tumidity of the surface behind the horn-cores merges into the broad anterior elevation of the squamosals. The suture between the postfrontals is not visible in front, but in the midline of the postfrontal surface there is a long, narrow fontanelle which extends back from a point in line with the posterior half of the horns to the anterior end of the raised parietal platform which enters into the formation of the posterior margin of the fontanelle. This opening is rounded behind and in front, and comes to a sharp edge at the margin. Within, the excavation has a smooth floor and extends to each side for some distance beneath the postfrontals.

Three smooth prominences occur in line on the broad anterior ridge of the squamosal, and in continuation there is an indistinct one in advance of the postfrontal suture, the tumid surface behind the supraorbital horn-core being one of the series, and the horn-core itself may be considered as the anterior culmination. In the midline of the coalesced parietals two obscurely marked elevations of a like nature occur in advance of the median shaft.

The coalesced parietals form the floor and side walls of the posterior end of the postfrontal fontanelle, to what extent is not known, but the parieto-postfrontal suture is probably at the anterior end of the narrow surface of bone seen in the superior view of the skull separating the fontanelle from the supratemporal fossa. This entry of the parietal into the formation of the postfrontal fontanelle occurs in both Styracosaurus and Centrosaurus.

The mouth or opening of the supratemporal fossa is rather narrow, and in coming from beneath the postfrontal it deeply undercuts the parietal platform and the squamosal, more especially the latter. The whole of the floor of the fossa at its mouth is supplied by the parietal, the squamoso-parietal suture being at the extreme outer limit of the floor. The sharp overhanging edge of the mouth of the fossa is continuous in its curve and is contributed to by the parietal, squamosal and postfrontal, to a less extent by the last than by the other two elements. In advance of the parietal platform the surface of the bone drops to a slightly lower local level, leaving the anterior termination of the platform sharply defined.

The lower jaw is strong and robust. The depth of the dentary at its midlength, measured from the inner alveolar border, is a little over one-third of its length. The angular enters largely into the exterior surface of the jaw posteriorly, its sutural junction with the dentary having much the same general direction as in *Ceratops canadensis*. Its external surface is much farther forward beneath the base of the coronoid process than in Triceratops. The surangular, articular and splenial are preserved and will be described at a later date. The coronoid process is strong and terminates anteriorly above in a narrowly rounded hook. The height of the alveolar border above the lower margin of the dentary decreases only slightly from front to back, and in this respect the direction of the border differs materially from that of *C. canadensis*, otherwise there is a general resemblance in the mandible of these two species. The lower teeth bear a very high keel, and the grinding surface, as displayed by those teeth which have been in use, is almost vertical.

The dorsal surface of the skull of Chasmosaurus is rather smooth throughout. Small vascular markings occur on the parietals behind the inclined platform and on the platform itself. The upper surface of the postfrontals show these grooves to a greater extent but not in so decided a manner as the supraorbital horn-cores and the epoccipitals which are the most rugose parts of the skull.

The skull has been prepared, as it appears in the figures, by its discoverer, Mr. Charles H. Sternberg, and his son, Mr. C. M. Sternberg.

MEASUREMENTS.	Feet.	Inches.
Estimated length of skull from midway between apices of parietal epoccipitals to front edge of rostral bone, about	5	5
Length of skull along median line from posterior parietal border to anterior end of dentary	4	7
Maximum breadth of crest	3	$5\frac{6}{8}$
Breadth between centre of orbits		11
Breadth between lower margin of lateral temporal fossæ	1	$6\frac{3}{8}$
Antero-posterior diameter of supraorbital horn-core near base		$2\frac{5}{8}$
Transverse diameter of same near base		2
Length of same, tip restored		$3\frac{1}{2}$
Length of squamosal from front end of process under lateral temporal fossa to back termination	2	$9\frac{1}{8}$
Length of coalesced parietals along median line from posterior border to front edge of raised portion between supratemporal fossæ	2	$6\frac{1}{8}$

Maximum length of intraparietal fontanelle (oblique)	1	8
Width of same	1	$1\frac{2}{8}$
Transverse diameter of parietal shaft at midlength		2
Length of lower jaw from back end of articular to front end of dentary	1	$8\frac{3}{8}$
Depth of dentary at midlength from inner alveolar border to lower margin		5
Vertical diameter of orbital opening		4
Horizontal diameter of orbital opening		3
Vertical distance of postfrontal surface between orbits above lower end of jugal	1	$1\frac{1}{2}$
Breadth of crown of tooth of lower jaw		$\frac{5}{8}$
Length of postfrontal fontanelle		$6\frac{1}{4}$
Depth of same anteriorly		$2\frac{1}{2}$
Depth of same posteriorly		3
Height of posterior edge of postfrontal above floor of supratemporal fossa		3

EXPLANATION OF PLATES.

PLATE XVIII.—Lateral view of skull of *Gryposaurus notabilis*, one-sixth the natural size.

PLATE XIX.—Skull of *Chasmosaurus belli*, from above; one-tenth the natural size.

PLATE XX.—Side view of same, similarly reduced.

Abbreviations.—*A*, parietal fontanelle; *AN*, angular; *AR*, articular; *B*, postfrontal fontanelle; *C*, supratemporal fossa; *D*, lateral temporal fossa; *DN*, dentary; *EO*, epoccipital; *FP*, postfrontal; *J*, jugal; *L*, lachrymal; *MX*, maxilla; *N*, nasal; *NO*, nasal opening; *OR*, orbit; *PD*, predentary; *PF*, prefrontal; *PM*, premaxilla; *Q*, quadrate; *QJ*, quadrato-jugal; *S*, squamosal; *SA*, surangular; *SO*, supraorbital.

NOTE.—The fact that the generic term Protorosaurus is already in use was overlooked by the writer, who now substitutes Chasmosaurus to designate the Belly River ceratopsian from Alberta. The new name has reference to the openings in the skull, more particularly to the great size of the intraparietal fontanelles.

SALIX HOOKERIANA BARRATT.

This willow, so abundant in low ground and swamps in the Lower Fraser Valley and on Vancouver Island, is, I think, not understood by the makers of books on the flora of Washington State, or perhaps the plant reaches fuller development in British Columbia. The capsule is very variable in its indument, being either densely tomentose, quite glabrous, or glabrous below or on the sutures and tomentose above, sometimes becoming nearly glabrous in this intermediate form. According to Hooker's description and figure the capsule is glabrous; but glabrous forms are not so common as tomentose. They occur both on the mainland and on Vancouver Island.

S. Hookeriana flowers at Vancouver in March, shortly after *S. Scouleriana*, from which it is easily distinguished by its furry-tomentose branchlets, which are very brittle at a point just above the fork; by its long style and short stigmas, and by its usually very large, erect, fertile catkins. *S. Scouleriana* has little or no style, long stigmas, merely puberulent branchlets and the fertile catkins soon recurve. The staminate catkins of *S. Hookeriana* are larger than those of *S. Scouleriana*, and sometimes in two sets—the second set not flowering for a month or six weeks after the first, when apparently no late pistillate catkins are in flower. It rarely produces stipules, a point about which Hooker was doubtful.

The closest allies of *S. Hookeriana* in British Columbia seem to be *S. Barrattiana* of the Rockies, which always has large stipules, and *S. Piperi* Bebb, if a few clumps occurring at Vancouver can be so assigned. These clumps have large, oblong leaves shining above and glaucous-pubescent below, and so far agree very well with Bebb's description; but the branches are slightly pubescent, the leaves firm rather than thin, and the capsule may have a very slight pubescence at the apex. The willow is thus, as far as the pistillate plant is concerned, intermediate between the form of *S. Hookeriana* with glabrous or slightly pubescent capsules, and *S. Piperi*. The staminate flowers have not been observed.

In the autumn form this willow quite differs from *S. Hookeriana*. Its leaves turn yellow, and fall late; while those of *S. Hookeriana* turn more or less blackish, and fall earliest of the coast willows. As the type of *S. Piperi* came from Seattle, this species may be expected to occur in southern British Columbia.

J. K. HENRY, VANCOUVER, B.C.

MEETING OF THE BOTANICAL BRANCH.

Held at the University Club rooms, 150 Elgin Street, on the evening of January 17th, the following members being present: E. D. Eddy, R. B. Whyte, L. H. Newman, C. J. Tulley, T. W. Dwight and J. R. Fryer.

Mr. L. H. Newman led in the discussion of a review of some recent work dealing with the phenomenon of variation in plants. He first reviewed some work done by Fruwirth on potatoes. Fruwirth investigated the variations occurring in successive generations of potatoes. In order to eliminate variations due to hybridization he sowed seeds taken from potato balls grown naturally, that is, no artificial crossing had been practised in producing this seed. After the first generation each succeeding one was produced from the tubers and not the true seeds of the preceding. Careful comparisons were made between the mothers and their respective progeny in different generations in order to observe and record any apparent deviation that might occur. Special attention was given to the colour of the skin and of the flesh of the tubers harvested, together with the size and shape of these. The variations in these features were very marked. Most of them were readily explainable by the principles of heredity, but in one case there were found in the second generation four plants which produced yellow-fleshed tubers, although the flesh of the mother sort was not yellow, but white. This form cannot be explained as recessive because yellow was dominant. No very satisfactory explanation was given for this occurrence. From the results of his investigation Fruwirth concludes "that it is possible to improve our present potato sorts by the continuous selection of desirable hills."

Mr. Newman then discussed briefly variations in pure lines of self-fertilizing plants. He stated that recent work indicates that in plants which are normally self-fertilizing there is practically no variation. While it seems certain that we must abandon the idea of the existence of continuous variation in certain classes of plants, yet we know from experience that strange forms do sometimes occur even in our so-called "pure" lines. While the appearance of many of these strange forms may be accounted for as crossing products, it has not been definitely proven that new forms cannot arise quite independently of intersexular combination. Forms appearing in this way have been termed "mutants" or "mutations" by DeVries, who believes that most new forms arise in this sudden independent fashion.

The speaker then reviewed an account published last year by Dr. Kiessling, of Bavaria, on an elaborate investigation into the origin of a form of two-rowed barley, which seems to show that this form is undoubtedly a mutation. In 1898, Dr. Kiessling obtained a sample of old Austrian barley from a farmer and tested it at the breeding station at Weihenstephan. From the crop of 1900 a number of plants were selected for pure line work. One of these survived the test and came to be propagated in a pure condition from year to year. In 1908, eighteen plants were selected out of this line to prove its constancy. The progeny from each of these plants proved to be constant with one exception. In this case the plants, on May 10th, were recorded as being somewhat less upright than those in the other cultures. The plants thus deviating were closely studied and their progeny carefully compared from year to year with the progeny of the original pure line. In 1911, it was found that the aberrant type was much more susceptible to cold than was the original mother line. Other evident differences between the two showed conclusively that a new form had arisen. Moreover, the new form showed its own modification curve, and therefore cannot be regarded as a modification of the original line. After much discussion as to an explanation of the origin of this new form Kiessling finally concludes the new type is an example of DeVries mutations.

J. R. F.

NOTES ON THE APOTHECIAL STAGE OF SCLEROTINIA CINEREA IN ONTARIO.

By J. E. Howitt, O.A.C., Guelph, Ont.

This fungus was known as *Monilia fructigena*, Pers., until placed in the genus *Sclerotinia* by Woronin in 1899. Recent investigations show that the American Brown Rot fungus of stone fruits is not identical with *Sclerotinia fructigena* occurring in Europe on pome fruits. It agrees more clearly with *Sclerotinia cinerea* and should be referred to that species. In the spring of 1902, Norton found the apothecial stage in abundance in peach and plum orchards in Maryland. In 1906, this stage was reported as being very common in the United States throughout the west. Up to the present time, however, pathologists have not regarded the apothecial stage of importance in the propogation of the fungus. Conidia adherent to bark or bud scales and the mycelium of the mummied fruits or blighted twigs have been considered to be the chief sources of infection. While these are undoubtedly important sources of infection, observations made by the writer during the spring of 1912 point to the possibility that in wet seasons the apothecial stage may be of primary importance in the dissemination of the fungus and the chief source of blossom infection.

In the course of some studies on the life-history of *Sclerotinia cinerea* a careful watch was kept for the appearance of the apothecial stage. On May 25th, 1912, Mr. W. A. McCubbin, my colleague in this work, found numerous apothecia under wild plum trees (*Prunus americana*) at Cedar Mills, Ontario. The soil in this locality is a sandy loam. Apothecia were produced from old plums buried from one to two inches in the sand and loam. These old plums had evidently been buried for some time in the soil, as last year's plums were still on the surface of the ground. When the apothecia were gathered it was observed that the asci in the more mature ones were discharging their spores. The blossoms at this time had nearly all fallen.

On May 29th, the writer paid a visit to Fruitland, in the Niagara district, Ontario, in search of the apothecial stage. A well cultivated plum orchard (chiefly Lombards) was visited. The soil was a fairly heavy clay loam. Numbers of apothecia were found growing from sclerotia in old dried mummied plums covered by moist earth or lying on the surface of the ground in low spots where water had lain for some time. A closer examination revealed the stipes of numerous apothecia that had evidently withered up as soon as the mummied fruit from which they were growing had been dried by the sun. In another plum orchard, the soil of which varied from clay loam to light sandy loam, many more apothecia were observed, and countless withered stipes indicated how prevalent the apothecial stage had been. When the apothecia were disturbed, the spores were discharged in fine brown dust-like clouds. The petals by this time had nearly all fallen but most of the calices were still intact.

A peach orchard on light, sandy loam was next inspected. In this orchard a heavy cover crop of winter rye was growing. Very few mummied fruits were found on the serface of the soil A number of apothecia were found, however, growing from the mummies buried in the sand. These were most abundant where the cover crop was heaviest and the soil dampest.

This was the first year that the apothecial stage was observed in Ontario. The continual wet weather during May without doubt accounted for the abundance of this stage of the fungus. It was observed that the apothecia were not produced except after heavy rains, and that they dried up and disappeared within a few hours after the weather became dry and warm. The very brief duration of the apothecia probably accounts for the fact that this stage has not been more generally observed by pathologists.

On the same dates that the apothecia were found in such abundance, mummied fruits and blighted twigs were examined to see if the mycelium was producing spore pustules. Though large numbers of mummies and twigs were examined none showed signs of spore pustules. These were not observed until a much later date. As the blossoms had nearly all fallen at this time, it would appear that the source of blossom infection is either conidia adherent to the bud scales or the apothecial stage produced from mummied fruits beneath the trees. It would seem from the observations made that large numbers of apotheica are produced in wet seasons and that the asci discharge immense numbers of spores during the blossoming period. It is, therefore, reasonable to suppose that the apothecia are one of the chief sources of blossom infection which later may result in twig blight. It is also possible that the ascospores account for much of the infection of the young fruit. It also seems likely that the apothecia are produced in more or less abundance every spring, but as they wither very quickly when the weather becomes dry they have not been observed, and hence the apothecial stage has been regarded of little importance in the propagation of the fungus and the continuance of the disease.

The writer hopes to continue these observations, as it is desirable to ascertain definitely the extent of the infection due to the production of apothecia in order that proper measures may be recommended for the control of this disease. Plowing under the mummied fruits has hitherto been considered one of the best means of preventing infection but if the apothecia are produced from old fruits which have been buried a year or more in the soil and brought to the surface by fresh plowing, this method would appear to be of little value.

Observations on this fungus were continued in the spring, of 1913. The apothecial stage was found in comparative abundance in plum orchards near St. Catharines. In order to determine whether the apothecia developed from mummied plums which had been buried in the soil for a year or more, or from mummied plums of the previous season, a number of mummied plums gathered in the spring of 1912 (the plums having been destroyed by the Brown Rot during the summer of 1911) were buried in loam and sand at different depths and left outside, exposed to climatic conditions until the spring, of 1913. They were then dug up and placed in moist chambers. Not a single apothecium developed from any of them nor were there any ones of the formation of sclerotia. Some mummied plums gathered last spring, which had hung on the trees or lain on the ground under the trees for the winter, were placed in moist chambers at the same time. On one mummied plum which had lain on the ground for the winter, a number of stunted, poorly-developed apothecia appeared. This experiment, though by no means conclusive, suggests that the apothecia may be developed from mummies of the previous years. These experiments and observations will be continued with the hope of clearing up this and other obscure points in the life-history of *Sclerotinia cinerea.*

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THE PROTECTION OF BIRDS IN AND AROUND OTTAWA*

By C. Gordon Hewitt, D.Sc., F.R.S.C.
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It is the purpose of this address to discuss, first, the general question of the protection of birds and the reasons why this is necessary; secondly, the economic value of certain common birds which we desire to protect; and thirdly, a proposal for the protection of the native birds around Ottawa.

The motives behind the widespread and increasing movement respecting the protection of our native birds may be included in two classes, namely, sentimental and practical. Most people, even in this material age, are sensible of feelings of affection towards our birds and are delighted when the return of the first spring migrants announces the termination of our long birdless winter. But the practical considerations underlying the movement are not so generally appreciated and for that reason æsthetic feelings will be assumed and the practical motives discussed.

Few people realize the place of insect pests in the general economy of life, but when it is understood that were it not for their controlling factors insects would in a few years destroy every form of vegetation, and consequently all animal life on the face of the globe, the significance of such controlling factors will be appreciated. In the United States it is estimated on a conservative basis that the annual loss on agricultureal and forest products is about eight hundred million dollars ($800,000,000). I have estimated that in Canada, on our field crops alone, the minimum annual loss due to injurious insects cannot be less than fifty million dollars; this does not take into account the enormous aggregate cost of controlling insect pests. And yet the most valuable insecticidal agencies we have are not only not encouraged but in many cases ruthlessly destroyed. Such a shortsighted and wasteful policy cannot and must not be continued.

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*Abstract of an illustrated lecture delivered before the Ottawa Field-Naturalists' Club, 10th February, 1914.

We are endeavouring to increase the productiveness of the soil; birds will assist in doing this by destroying those agencies, namely, insect pests which decrease the amount produced.

The quantity of insect food consumed by birds is almost incomprehensible, but the facts set forth by various investigators on this continent and in Europe give us some idea of the extent to which insects go to make up the diets of birds. Insects constitute 65 per cent. of the total yearly food of woodpeckers, 96 per cent. of that of fly-catchers, and 95 per cent. of the yearly food of wrens. Upwards of 5000 insects have been found in a single bird's stomach. The value of the birds is increased by the fact that at the time when insects are most abundant birds are most active and require most food, especially animal food, to feed their young. A bird normally requires a large amount of food owing to its active habits and high temperature, all of which bodily functions demand a constant and plentiful supply of fuel in the shape of food. A young crow will eat twice its weight in food; a robin weighing three ounces was found by Nash to consume five and one-half ounces of cutworms in a day. It is calculated that a pair of tits and the young they rear will consume about 170 pounds of insect food during a year. These facts and others to be given later will indicate the enormous destruction of insect life that is accomplished by the presence of birds. They constitute one of the fortunate balances of nature. But man is constantly upsetting the balance. Woodlands are cut down and give place to open fields; snake fences give way to wire; subdivisions and town lots obliterate the waste places and often the swamps. All these circumstances tend to drive away the birds formerly resident and breeding in such localities. Then outbreaks of injurious insects occur and their depredations are increased and prolonged by reason of the absence of such important enemies. Therefore, our aim should be to restore the balance by attracting the birds back to our parks and natural reservations.

Not only do birds destroy insect pests, but they contribute to the destruction of weeds. Certain species of our native sparrows are large consumers of such weed seeds as bindweed, lamb's quarters, ragweed, amaranth, pigeon grass, etc. Judd records the result of the examination of over 4000 stomachs of twenty species of sparrows. It was found that for the entire year weed seeds form more than half their food, and during the colder months of the year these seeds constitute about four-fifths of the food of many species. A single bird will often be found to have eaten 300 seeds of pigeon grass or 500 seeds of lamb's quarters or pigweed. Beal estimated that the tree sparrow may consume one-quarter ounce of weed seed per day, and on that basis, in a state the size of Iowa, this species would consume about 800 tons of seeds annually.

It is important to point out, however, that the weed-destroying power of graminivorous birds may be exaggerated if the question is not investigated with great thoroughness, for while the powerful gizzards of some birds may grind up the hardest coated seeds, in other cases seeds may be capable of germination after passing through the digestive tract, as Collinge has shown in a number of cases in English birds. In such instances the birds would act as disseminators of weed seeds. Then again, in the case of insectivorous birds, besides destroying noxious insects, they will destroy various kinds of insects which are useful by reason of their parasitic habits upon noxious insects. These facts indicate that the question of the economic status of a bird is not always an easy matter to determine and demands *thorough* investigation in each case.

In certain instances useful birds eat grain or fruit. The Horned Larks occasionally eat grain, vegetable food constituting about 80 per cent. of their total food. Six-sevenths of this total amount of vegetable food consists of the seeds of such weeds as foxtail, amaranth, ragweed, and bindweed. It surely is not too much to ask that, in view of the good they effect, a little injury shall be overlooked, especially as they make no charges for the good work they accomplish. It has sometimes seemed to me that in the case of those useful birds which sometimes take to fruit eating, it is cheaper to protect the fruit from the birds than from the insects. As insecticides, birds are the cheapest and most generally efficient that can be found.

The feeding habits of a few of our common species of birds which should be protected may now be considered. The Robin (*Planesticus migratorius*) probably comes first. Early in the year it feeds extensively on cutworms, those insidious enemies of our garden plants and crops; in March they constitute over a third of the robin's food. It is accused of fruit eating, and yet of all the vegetable matter it consumes a large proportion consists of wild fruits; 330 stomachs contained 58 per cent. vegetable matter, of which 47 per cent. consisted of wild fruits and 4 per cent. cultivated fruits.* The Bluebird (*Sialia sialis*) is not so common as formerly in the Ottawa district, having probably been driven away by the encroachments of man. Charming in its habits it responds readily to encouragement, building in hollow trunks and cavities. Insects such as grasshoppers, beetles and caterpillars constitute about 68 per cent. of its food.

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*Except where it is specifically stated otherwise, these analyses of stomach contents are taken from the publications of the Biological Survey of the U. S. Department of Agriculture, to which the reader is referred for further details.

With the possible exception of the house wren, probably no other birds so readily take advantage of artificial nesting places as the Chicadees (*Penthestes atricapillus* and others) and Tits. Their unremitting search for insects on every branch, twig and leaf is a fascinating sight and the good they accomplish is difficult to conceive. A Blue Tit will destroy six and a half million insects in a year, and in bringing up a family of about twelve to sixteen young ones, about twenty-four million insects would ultimately be accounted for. Especially valuable are they in the destruction of the eggs of certain species of defoliating caterpillars, such as the canker worms and tent caterpillars, the moths of which deposit their eggs on twigs. Graf, in Switzerland, states that three blue-tits and three cole-tits consumed 8000 to 9000 insect eggs daily; three marsh tits, one cole-tit, a long-tailed tit and a golden crested wren consumed 600 caterpillars in 100 minutes. The pupae of the codling moth and the hibernating forms of plant lice do not escape the sharp eye of these small acrobats. The little White-breasted Nuthatch (*Sitta carolinensis*) which may be seen running not only upwards but also downwards on the trunks of trees, has somewhat similiar habits to the Chicadees. Over 50 per cent. of its food consists of insects. The House Wren (*Troglodytes aedon*) has suffered much by the inroads of the quarrelsome English sparrow which drives it out of its nesting places on every possible occasion. Nevertheless, this confiding little bird which charms us so much with its little bubbling song and exacts such a heavy toll on insect life will gladly accept a nesting box out of which the sparrows may be kept by hanging it rather low down, and having the entrance hole as small as possible.

The Purple Martin (*Progne subis*) formerly nested in hollow trees, but the advent of man encouraged it to nest about his domicile. In some parts of the country, I have noticed the fact particularly in certain sections of New Brunswick, one may see martin houses erected on poles and this form of encouragement is very successful, although the English sparrows are a constant source of trouble to the rightful owners. The value of the martins and swallows around the house and buildings as insect destroyers is appreciated by all who have encouraged them. The Tree Swallow (*Iridoprocne bicolor*), which nests in hollow trees, is not so abundant in certain sections of Ontario as formerly. Reporting the success of nesting boxes during 1913, Mr. W. E. Saunders, of London, Ont., writes: "Another lot of boxes which were put in place on an island in the Rideau Lakes were a source of actual competition among the tree swallows, there being more pairs than there were nests, and considering the fact that these birds are almost extinct in south-western Ontario, where they were formerly tolerably common, it would seem an excellent policy to encourage them in the Ottawa district while you have them there".

Two of the woodpeckers may be attracted by the use of nesting boxes. The Flicker (*Colaptes auratus*), which occurs in and around Ottawa, feeds largely on ants; a single stomach has been found to contain over 5000 ants. In another instance 28 white grubs, one of our worst pests of grass land and certain crops, were found in the stomach of a flicker which feeds largely on the ground. It also feeds upon wild fruits, such as the wild black cherry. The Downy Woodpecker (*Dryobates pubescens*) is a most valuable ally, as it feeds largely on beetles that destroy trees by boring into the bark and timber. An examination of 723 stomachs showed that 76 per cent. of the diet was animal food, consisting chiefly of insects.

Reference has already been made to the weed-destroying habits of our native sparrows. One of the first birds to arrive in the spring, breaking the long winter silence with its welcome little song, is the Song Sparrow (*Melospiza melodia*), which is very domestic in its habits. About three-fourths of its food consist of weed seeds and one-fourth of insects. Beetles, especially weevils, form the greater portion of the insect food. A thick hedge, dense shrubs or piles of logs provide suitable nesting places for this most welcome of our sparrows. The Chipping Sparrow (*Spizella passerina*), whose confiding ways give it a warm place in our affection, has somewhat similar nesting habits to the former. It is, moreover, the most insectivorous of our sparrows. About 42 per cent. of its food consists of insects and spiders, and caterpillars make up the major portion of the insect food, especially when the young are being reared, when as many as 17 feedings per hour, on an average, for a brood of our nestlings have been recorded. The retiring and sombre Junco or Snowbird (*Junco hyemalis*), destroys insects and feeds on weed seeds. An examination of 500 stomachs gave 23 per cent. animal food (caterpillars, bugs and beetles), and 77 per cent. vegetable food, of which over 61 per cent. consisted of weed seeds. In September the proportion of weed seeds may rise as high as 95 per cent. of the food.

Before discussing the details of the proposal for the protection of the Ottawa birds, it will be of interest to refer to the results of certain schemes of bird protection which have been adopted in other countries.

The greatest exponent of the practice of bird protection is undoubtedly Baron von Berlepsch, and to him we are indebted for the splendid example he has given at Seebach in Germany. His ideas have been adopted by various states in Germany and in the countries where the protection of birds and the provision of nesting boxes constitute an important and necessary adjunct of forestry methods. An instance, given by Baron von Berlepsch, of the practical value of bird encouragement may be quoted. The Hainich wood, south of Eisenach, which covers several square miles, was stripped entirely bare in the spring of 1905 by the caterpillars of the Oak Leaf-roller Moth (*Tortrix viridiana*). The wood of Baron von Berlepsch, in which there had long been nesting boxes, of which there are now more than 2,000, was untouched. It actually stood out among the remaining woods like a green oasis. At a distance of a little more than a quarter of a mile farther, the first traces of the plague were apparent, and at the same distance farther on still it was in full force. It was plain proof of the distance the tits and their companions had gone during the winter and after their breeding time. Similiar observations were made during a plague of the same insect (*Tortrix viridiana*) in the Grand Duchy of Hesse, where the protection of birds has been carried on in a sensible and energetic fashion for over ten years. Of 9,300 boxes hung up by the Government in the State and Communal woods of the Grand Duchy of Hesse, 70 to 80 per cent. were occupied in the first year and in 1907 all were inhabited. On and near Baron von Berlepsch's Seebach estate, 90 per cent. of 2,000 nest boxes in one wood were occupied, and nearly all of 500 and 2,100 in other localities. In Hungary similar measures are taken largely owing to the admirable work of Otto Hermann, one of the foremost European advocates of bird protection.

Some years ago when investigating the depredations of the Larch Sawfly (*Nematus erichsonii*) in the English Lake district I was impressed with the value of birds as natural means of control, and as birds in the worst infested district, namely Thirlmere, were not so abundant as they should have been, it was recommended that they should be protected and encouraged by means of nesting boxes. The corporation of the city of Manchester owns Thirlmere, this lake being their water supply, and they distributed nesting boxes of the pattern which I devised and which is illustrated herewith. (Fig. 1). The advantage of this box was that it could be made out of the slabs or rejected outer portions of the lumber bearing the bark. Three equal lengths of the slab are nailed together to form three sides of a long box, the outside of which, bearing the bark, was round and the inside square. The fourth side is made of a flat piece of wood forming the back of the box; this piece is longer than the other sides and projects above and below the box, thus providing means of attaching the box to the tree (see Fig. 2). The top and bottom of the box may be made of slab wood. Several holes should be bored in the bottom, which is nailed on, to keep the nest dry. The top is hinged to the back board and when in use is fastened down by means of a screw, which permits the lid to be opened for the purpose of cleaning out the old nests. By so utilizing waste lumber, these boxes were made very cheaply at the sawmill. A boy could readily make similar boxes. Plate XXI shows such a box in use. In the first year (1908) 60 boxes were distributed and 31 per cent. were occupied. The number of boxes was increased yearly until in 1911 there were 347 boxes, of which 66 per cent. were occupied.* I am informed that in 1913, 75 per cent. of the boxes were occupied. In addition to the provision of nesting boxes, feeding houses of the Hessian type (Plate XXII) were erected for the purpose of feeding the birds in the winter

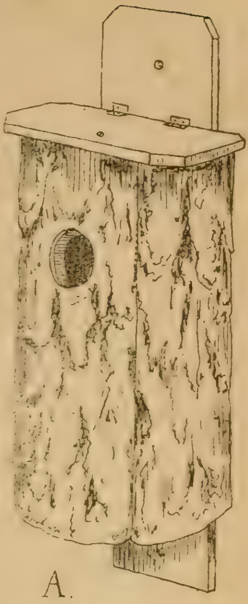

Fig. 1

Nesting Box Made of Slab-wood Ready for Hanging.

In addition to the provision of nesting places for those birds nesting in cavities and hollow places, the protection of birds involves the carrying out of other measures also. For birds nesting on or near the ground piles of logs or brushwood may be left in sheltered places and thickets of closely growing shrubs and vines permitted to remain here and there. Piled logs will also provide shelter for many birds during inclement weather. While most of our birds leave us during the winter, except in certain places where the chicadees may be found, there are certain occasions where feeding may be adopted with advantage. Not infrequently after the arrival of certain of our early migrants in the spring a cold spell and snow occurs. On such occasions feeding can be resorted to with great advantage. The fact that birds require water is not so generally

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*For further particulars and illustrations see Bull. 10, Second Series of the Experimental Farms, Dept., Agric., Canada, entitled "The Large Larch Saw Fly."

The Berlepsch Nesting Boxes in various sizes may be obtained from the Royal Society for the Protection of Birds, 23 Queen Anne's Gate, London, S.W., England, who will gladly furnish a price list; or from the manufacturer: Hermann Scheid, Büren, Westphalia, Germany.

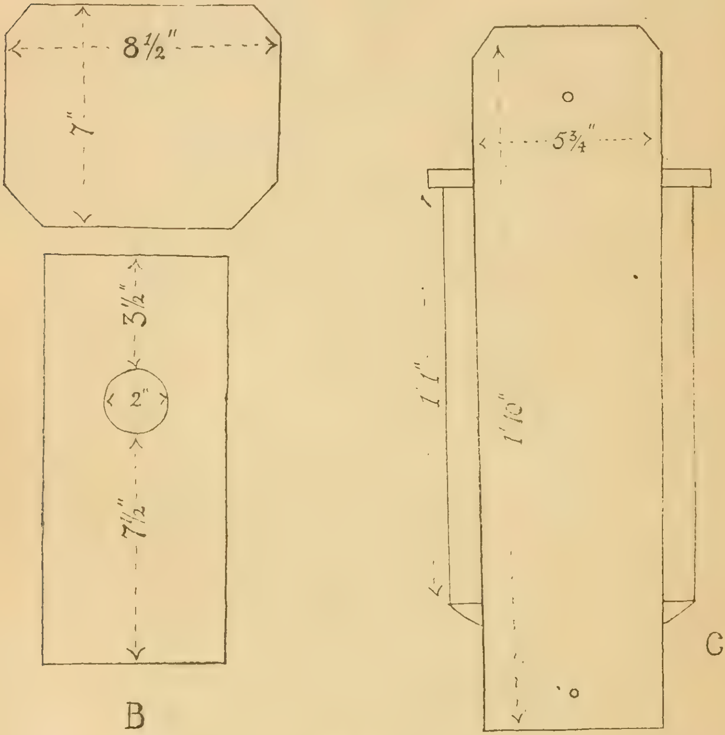

Fig. 2

Structural Details of Nesting Box Shown in Fig. 1 B.—Lid on Front of Box. C.—View of Box from Back.

realized as one would wish. Especialy is this the case during our hot summer months. One of the most attractive additions which can be made to a garden is a bird's drinking trough or fountain. This should be shallow enough to permit the birds to take a bath. The best type of artificial bird water supply for a garden is a shallow pool, two or three feet in diameter, and a few inches deep, in which a few reeds and water plants are planted. If this is placed in a wooded corner of the garden or shrubbery it will be constantly visited by all kinds of small birds.

The foregoing discussion of the advantages and methods of bird protection leads me to the chief object of this lecture, namely, the outlining of a definite scheme for the protection and encouragement of the birds of Ottawa, which scheme, I am pleased to say, has been enthusiastically adopted by the Ottawa Field-Naturalists' Club. Those who have lived in Ottawa for a number of years will have observed with regret the destruction one by one of places which were the haunts of many wild birds The rapid growth of the city and the outward march of the streets and houses have driven the birds from their former quarters. We are now witnessing the destruction of one of the most delightful of all nature spots around Ottawa, namely Beaver Meadow. The city is gaining in population and taxes at the expense of natural beauty. But as we cannot and should not wish to prevent such extension, we should take every means possible to offset the losses in natural beauty so occasioned.

There are within the city limits, but at present on the outskirts of the built-over districts, two areas unequalled by their natural beauty for the purpose we have in view. I refer to Rockcliffe Park and the grounds and Botanical Garden of the Dominion Government's Experimental Farm. The former, being a piece of woodland and forest rescued from the hand of the lumberman and builder, is one of the most beautiful natural parks in eastern Canada. The Experimental Farm, laid out and planted about twenty-six years ago,is even better suited to the purpose in view, owing to the abundance of trees and shrubs of all kinds, especially those bearing wild fruits. Since the establishment of the farm, efforts have been made to prevent the destruction of the birds and the robbing of their nests and Mr. W. T. Macoun, the Dominion Horticulturist, showed great zeal in this protection.

It is proposed to regard these two areas as bird sanctuaries in which steps shall be taken not only to prevent the destruction of the birds and the despoiling of their nests, but also to encourage their presence by providing those species which nest in holes and cavities with nesting boxes and sites. I am very pleased to say that the Ottawa Improvement Commission have consented to provide and distribute this spring two hundred and fifty nest boxes in Rockcliffe Park, and to constitute the same as a bird sanctuary. The Director of the Experimental Farms has agreed to the distribution in the spring of one hundred and sixty nesting boxes in the grounds of the Farm and the Botanical Garden, which wlll constitute a sanctuary. Apart from the æsthetic motives, the practical value of the encouragement of birds in both these places is of inestimable importance, as they constitute the most efficient protective agencies of the trees that can be secured, and the cost of their assistance—the cost of the nesting boxes, etc. regarded in the light of an insurance premium against insect depredations, is at the lowest rate imaginable.

The existence of two such bird sanctuaries will undoubtedly tend to prevent the gradual disappearance from the Ottawa district of a number of birds which are becoming less abundant than formerly. Further, it is reasonable to expect that when the northerly migrations are taking place in the spring, the encouragement we are arranging to offer will meet with a response, and birds which otherwise would have passed on will stay with us through the season to our profit in every way. The scheme will afford the best check that we can adopt in preventing, so far as is possible, the gradual departure of a number of our native birds from the Ottawa district.

The successful carrying out of this scheme will require the sympathy and willing co-operation of all. The Field-Naturalists' Club is honoured by having as its patron H.R.H. the Duke of Connaught, Governor-General of Canada, who has requested me to express his warm sympathy and interest in this proposal. Mr. Borden, the Prime Minister, to whom I explained the scheme wrote: "It is needless to say that the proposal which you have in hand commands my entire sympathy." Sir Wilfrid Laurier has for some time urged the adoption of such a scheme. The Field-Naturalists' Club feels that it can rely upon the assistance of all those who have the preservation of the beauty and charm of our city and its surroundings at heart. With a view to assisting in the suppression of the wanton destruction of nests by robbing and birds by small rifle shooting on the part of boys in and around the city, the assistance of the Boy Scouts is being secured. Col. A. P. Sherwood, Commissioner of Dominion Police, writes: "I assure you that you could not have appealed to anybody more sympathetic in regard to the protection of our native birds, and I will certainly have this matter taken up at once by the Local Council of Boy Scouts". It seemed to to me that as protectors of bird life and as policemen, the Boy Scouts would furnish an unrivalled auxiliary in this work. The idea is in accord with the spirit of the Boy Scout movement and the influence of such boys upon their more wayward and less enlightened brothers would undoubtedly be beneficial.

Finally, we must remember that the results of our action along the lines I have indicated will not influence Ottawa alone.

The activities of the Capital are observed and recorded throughout the country, not always to our credit The force of example in such a protective movement will surely have effect on other places. Those who have travelled throughout Canada know how lightly the protection of birds is regarded, especially by those to whom it is most essential. The Provincial Governments have their regulations governing the protection of birds, but it is only by education and example that any real progress will be made in this movement which has for its object the guarding of our allies in the protection of our crops and the preservation of the most beautiful forms of animal life.

LITERATURE WHICH MAY BE CONSULTED

"Useful Birds and their Protection," by E. H. Forbush, Massachusetts State Board of Agriculture, 437 pp., 171 figs., 56 plates. 1905.

"Birds of Ontario in Relation to Agriculture," C. W. Nash, Ontario Department of Agriculture, 124 pp., figs. 1913.

"How to Attract and Protect Wild Birds," Martin Hiesemann, Trans. by E. S. Buchheim, Witherby & Co., London, 86 pp., figs. 1908

Bulletins, Nos. 3. 9, 13, 15, 21, 23, 24, 30, 32, 34, 37, 44, of the Biological Survey, Farmers Bulletins Nos. 54, 497, 506, 513, and Year Book for 1895, of the U.S. Department of Agriculture. Farmer's Bulletin No. 513 entitled "Fifty Common Birds of Farm and Orchard" was also republished in the National Geographic Magazine, June, 1913.

MEETING OF THE ENTOMOLOGICAL BRANCH

The third meeting this winter was held at the residence of Mr. F. W. L. Sladen on the evening of February 5th. Present: Dr. C. Gordon Hewitt, Messrs. W. H. Harrington, A. Halkett, Arthur Gibson, J. M. Swaine, Norman Criddie, V. Kitto, A. E. Kellett, J. I. Beaulne and F. W. L. Sladen.

Mr. Sladen opened the proceedings by exhibiting his world collection of Bumble Bees, and drew attention to the different colour schemes they displayed. These colour schemes are not confined to the natural groups but to particular regions. In Europe one common colour scheme is a uniform tawny yellow, another, probably the commonest, a black ground with two yellow bands and a white or tawny tail. Black with a bright red tail is a third pattern. This is a form of melanism. In

Denmark and Southern Scandanavia nearly all the species are much darker than usual. Surrounding this region is a wide circle including Britain and the Swiss Alps, in which the species are less extensively darkened. Outside this circle, for example, the Pyrenees and Northern Scandanavia, there is hardly any tendency to melanism. A colour scheme common to Europe and America is dull yellow with a black inter-alar band. The dominating pattern in North America is pale greenish yellow with a broad black tail, exemplified in *Bombus vagans*, *perplexus* and *impatiens*. Another North American pattern is pale yellow with a black band across the thorax and a red band across the abdomen. These instances of regional convergence are sometimes stronger in the queen than in the male, and Mr. Sladen suggested that this might be because the queen probably needs to display warning colours more than the male on account of a period in the life cycle of the bumble bee, lasting about a month, in which the existence of the race depends upon a small band of slow-flying, heavily-laden queens that would easily fall a prey to any bird that might care to pursue them. Mr. R. I. Pocock, Curator of the London "Zoo", found that bumble bees were distinctly distasteful to birds.

Dr. Hewitt brought forward a recently published monograph, by Dr. F. W. Cragg, of the Indian Medical Service, on the comparative anatomy of the proboscis in the blood-sucking flies, in which the author shows that these flies can be arranged in a series commencing with those flies which are blood-suckers by habit but have no biting mouth parts, namely, certain species of *Musca*, and passing on through those which are provided with more or less efficient biting organs, such as *Philaematomyia* and *Hæmatobia*, to those forms, such as *Stomoxys* and *Glossina*, which have entirely lost the characteristic structure of the labella by means of which the non-biting flies absorb nourishment. The probable evolution of the blood-sucking muscidae from the non-blood-sucking forms has a possible bearing on the the theory concerning the origin of the Haemoflagellates.

Dr. Hewitt also called the attention of the members to Dr. Graham-Smith's recent book on "Flies and Disease" in which he brings forward a greater amount of evidence, chiefly original, in regard to the dissemination of bacteria than has hitherto been submitted by any investigator in the field.

Mr. Harrington showed specimens of the Cotton Boll Weevil, and referred to the enormous damage done by this insect in the Southern States. Dr. Hewitt said that at the recent Meeting of the Entomological Society of America at Atlanta, Dr. Hinds had read a most interesting paper in which he showed that this pest had been an important factor in rousing the farmers to practice better methods and to adopt rotation and co-operation, and had uplifted them socially and in other ways. Mr. Harrington also showed some Curculionidae that he had taken in Japan, and called attention to their large size and bright colours as compared with the representatives of this family in Canada.

Mr. Gibson exhibited Sir George Hampson's recent volume (XIII) of the Catalogue of the Lepidoptera Phalænæ in the British Museum, the subject of which is the classification of a part of the subfamily Catocalinæ and the subfamilies Mominæ and Phytometrinæ. He mentioned specially two genera, viz., *Zale* and *Phytometra*. The latter includes species which were placed under the old name of *Plusia*. The volume is of much value to Canadian students. He also spoke briefly on "Some little-known Cutworms." The species discussed were *Barathra curialis*, *Mamestra atlantica*, *Agrotis aurulenta*, and *Porosagrotis orthogonia*. The life history of two former species were studied some years ago. The larvae of the first named occurred throughout eastern Canada in 1905, and much loss was occasioned through its ravages to garden plants, both vegetable and ornamental. The last named species, which has been referred to under the name *delorata* in publications of the Division of Entomology, was chiefly discussed. This cutworm, which is a new destructive form, occurs in southern Alberta and during 1911 and 1912 thousands of acres of grain were destroyed by it. Mr. Gibson explained the work which the Division has been doing in the study of the life history, habits of the larvae, control measures, etc.

A general discussion of sundry subjects, entomological and otherwise, brought a very pleasant evening to a close

F.W.L.S.

CORRESPONDENCE.

EDITOR, OTTAWA NATURALIST: In 1913, a number of bird nesting boxes were put up in various parts of the country for the accommodation of birds that nest in cavities. This work was furthered through your own kindness in allowing a notice of the importation of these boxes to appear in the columns of the OTTAWA NATURALIST and the result was that the demand for these nesting boxes which were supplied to the inquirers at actual cost was greater than the supply, and consequently I am bringing out a further quantity this year.

The reports from the use of these boxes are very encouraging. One friend near Hamilton put up several Flicker boxes and had every one of them occupied. He also had Bluebirds and Wrens in the smaller sizes. Another lot of boxes which were put in place on an island in the Rideau Lakes were a source of actual competition among the Tree Swallows, there being more pairs than there were nests, and considering the fact that these birds are almost extinct in south-western Ontario, where they were formerly tolerably common, it would seem an excellent policy to encourage them in the Ottawa district while you have them there.

The last importation of these Berlepsch Nesting Boxes cost 43 cents for the Wren size, 55 cents for the Bluebird size and $1.29 for each of the two sizes for Flickers and Screech Owls. It is expected that the cost this year will be just about the same. I shall be glad to reserve for members of the Ottawa Field-Naturalists' Club any number that they may request and would suggest that in shipping to Ottawa I might make a single shipment to some central point, as otherwise the expense for freight on shipments of one or two boxes would be unreasonably high.

The birds which most readily use these nests are Wrens, Bluebirds, Tree Swallows and Flickers, all of which are not only worthy of protection and encouragement but are also delightful neighbours.

W. E. SAUNDERS, LONDON, ONT.

BOOK NOTICE.

BIRDS OF ONTARIO IN RELATION TO AGRICULTURE.—By Charles W. Nash: Ontario Department of Agriculture; Bulletin 218; 5th edition, 124 pages, 48 illustrations.

A copy of the new edition of this publication recently came to hand. The importance of a study of our insectivorous birds cannot be overestimated. The service they render to the agriculturist, or horticulturist, in feeding upon injurious insects, destroying field mice, etc., and in devouring weed seeds, is of the utmost value. The author has, for many years, studied specially the feeding habits of our birds, and the results of such work is invaluable. Much original information, therefore, appears in the bulletin; the illustrations are from his own drawings. In the discussion of the different species, descriptive notes are given of the adult, the young, and the nesting habits. The fact that it has been found necessary to print five editions of this bulletin speaks volumes for its usefulness. A. G.

MEETING OF THE BOTANICAL BRANCH.

February 14th, at the home of Mr. A. E. Attwood, the following members present: L. H. Newman, N. Criddle, J. Dickson, R. B. Whyte, C. J. Tulley, Dr. Blackadar, W. T. Macoun, A. E. Attwood, J. R. Fryer.

Mr. W. T. Macoun led in a discussion of the subject, "The Wild Fruits of Canada," describing many forms, especially those which give promise of economical usefulness.

APPLE—Two species of wild apple growing in Canada were mentioned—*Pyrus coronaria* (American Wild Crab Apple) and *Pyrus rivularis*, a western species. The former is the poorest we have and not much use is likely to be made of its fruit. A double-flowered variety of a species closely related to this, known as Bechtel's Crab, blooms at the end of May, and its flowers are so large and fine that it would make a beautiful ornamental tree. The tree may be obtained by grafting or budding.

PLUMS—Four species were referred to—*Prunus nigra*, *P. americana*, *P. pumila* (sand cherry) and *P. maritima* (Beach plum). *Prunus nigra* is found from Newfoundland to Manitoba along the Great Lakes. It is a very tough tree and is not broken down by heavy snowfalls. In this respect it is in contrast to *P. americana*. The fruit of *nigra* is all red, or all yellow, or red on one side and yellow on the other. Its skin is soft and dissolves easily. The period of ripening is early and lasts about a month. There is probably a great future for *P. nigra*. These trees are practically self-sterile, so that it is necessary for two or more individuals to grow together. *P. pumila* bears some very good fruit and some that is of no use. *P. maritima* has not as yet proved to be of any value.

CHERRY—*Prunus serotina* (Wild Black Cherry), *P. virginiana* (Choke Cherry) and *P. pennsylvanica* (Bird Cherry) were mentioned. *P. serotina* is a large tree, the main value of which is in its wood. The fruit has a strong and a trifle bitter taste. *P. virginiana* grows as far north as latitude 62. The fruit of this plant varies tremendously. Some bushes bear fine fruit, others very poor. *P. pennsylvania* grows far north and as far west as British Columbia. Its fruit is small, but varies somewhat in size and has a fine acid flavour. It is used for stock on which ordinary cherries are grafted.

GRAPE—*Vitis vulpina* grows wild in Manitoba, and there are great possibilities of developing from it a grape which will be useful as fruit to the western provinces. *Vitis labrusca* (Fox

Grape) will not thrive in Manitoba; its fruit buds are usually killed by frost in the spring.

Rubus idaeus aculeatissimus, formerly *Rubus strigosus*, (Wild Red Raspberry) grows very far north. *Rubus occidentalis* (Black Raspberry) does not range far north. Cultivated varieties are not hardy at Ottawa. These two species hybridize, giving a form known as *R. neglectus*, the fruit of which is larger than that of either of the original species. The Blackberry has not a wide range. It does not grow in Manitoba. In British Columbia there is a raspberry known as the Salmon Berry, *Rubus spectabilis*, for which one has to acquire a taste. *Rubus triflorus* is a low-growing form and its fruit is a red berry with a delicious flavour *R. Chamaemorus* has a very seedy berry for which a taste has to be acquired.

CURRANT—*Ribes hudsonianum* grows as far north as latitude 57 and *R. floridum* (Wild Black Currant) as far as latitude 54, while *R. lacustre* (Swamp Black Currant) runs almost to the Arctic Circle. The Missouri Currant grows in southern Alberta and is quite hardy.

The gooseberries mentioned were *Ribes oxyacanthoides* (Smooth Gooseberry) and *Ribes Cynosbati* (Spring Gooseberry).

BLUEBERRY—These were represented by *Vaccinium pennsylvanicum*, but there are several species which produce good fruit. These do not grow on sweet soil; they require acid soil. This explains why attempts to grow them have often been unsuccessful.

CRANBERRY Cranberries are cultivated in Nova Scotia and Prince Edward Island. They grow in bog land. The main difficulty is to prevent freezing. *Vaccinium oxycoccus* remains under the snow in good condition and is therefore a valuable species.

Viburnum Opulus, var. *americanum* is a high bush form growing in the western provinces. Its fruit is substituted for cranberries and used chiefly for jellies.

JUNEBERRY—This fruit is appreciated in the prairie provinces. *Amelanchier alnifolia* grows in the west and *Amelanchier canadensis* abounds in Ontario.

STRAWBERRY—The strawberry grows almost to the Arctic Circle. Two species were mentioned—*Fragaria virginiana* and *F. chiloensis*, the latter of which grows from Alaska to South America and from it originated the English strawberry.

There are many of our wild fruits which have delicious flavour and many others which by improvement can be developed into fruits quite as fine and valuable as those we now value most.

J. R. F.

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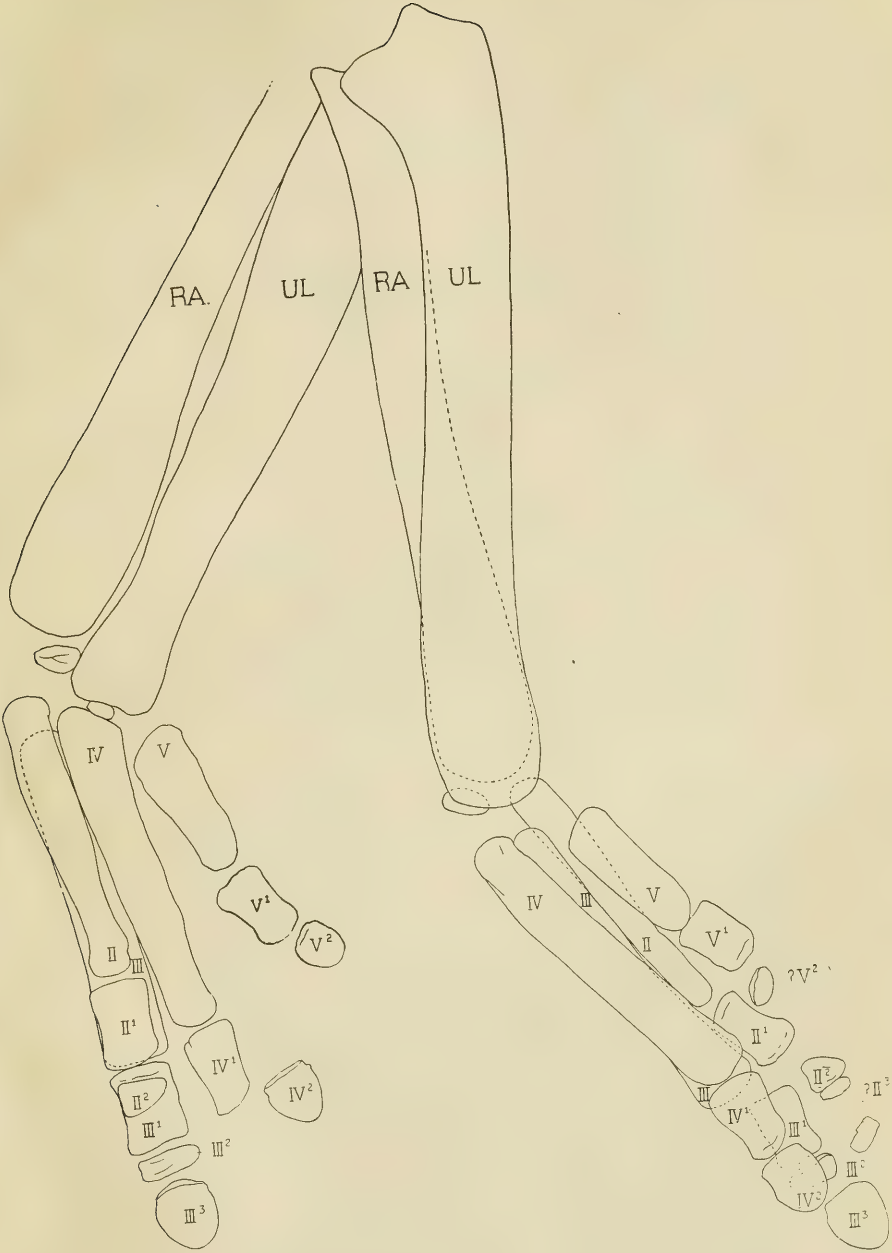
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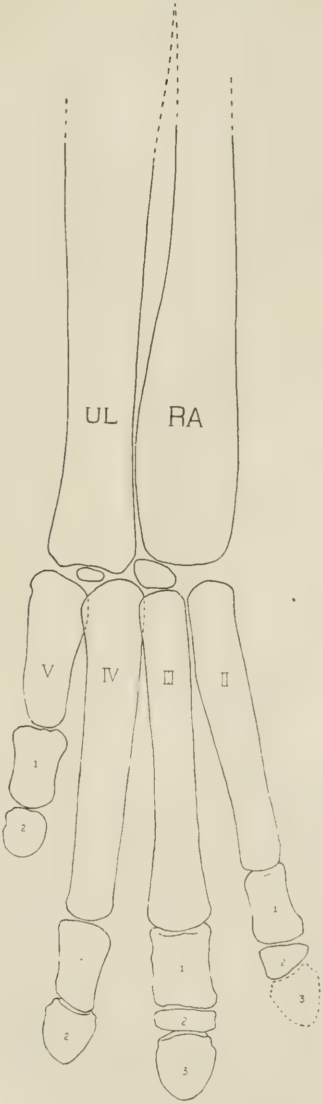
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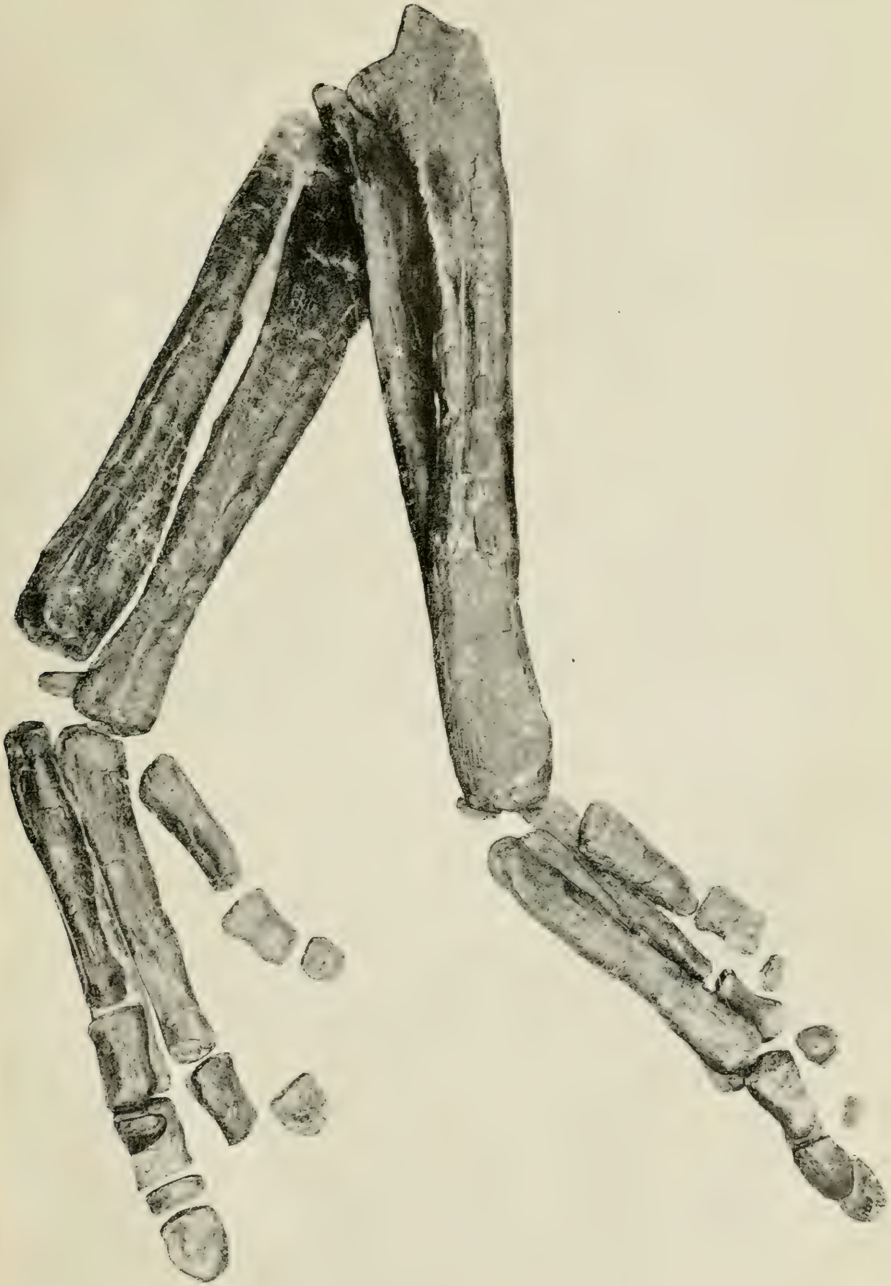
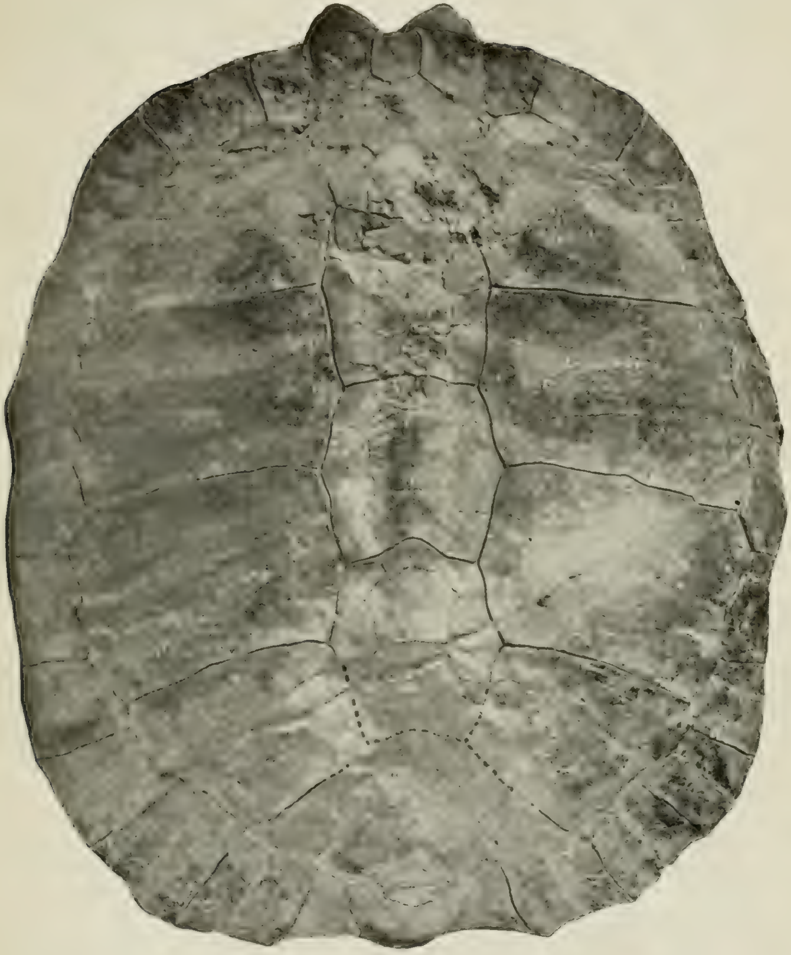
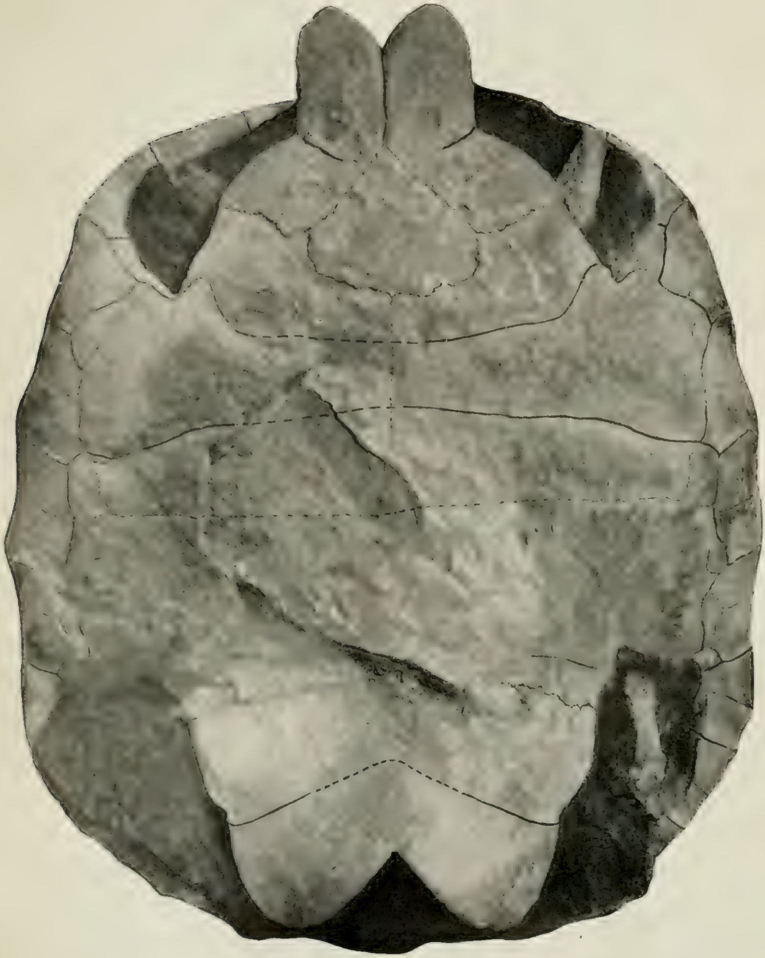
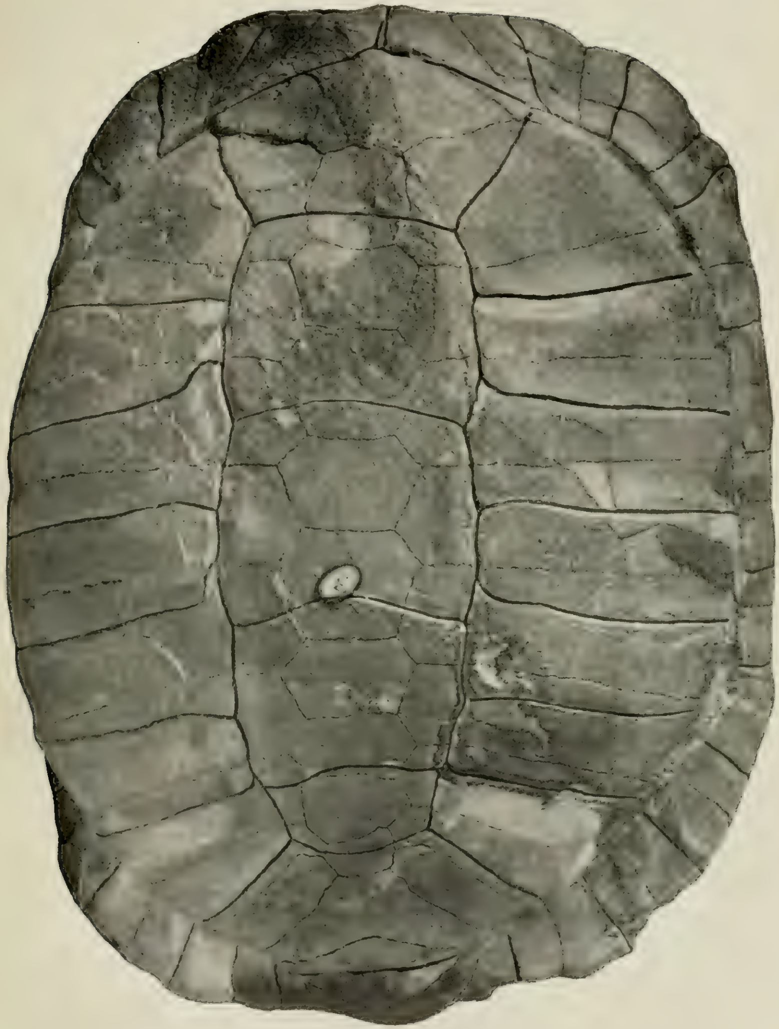
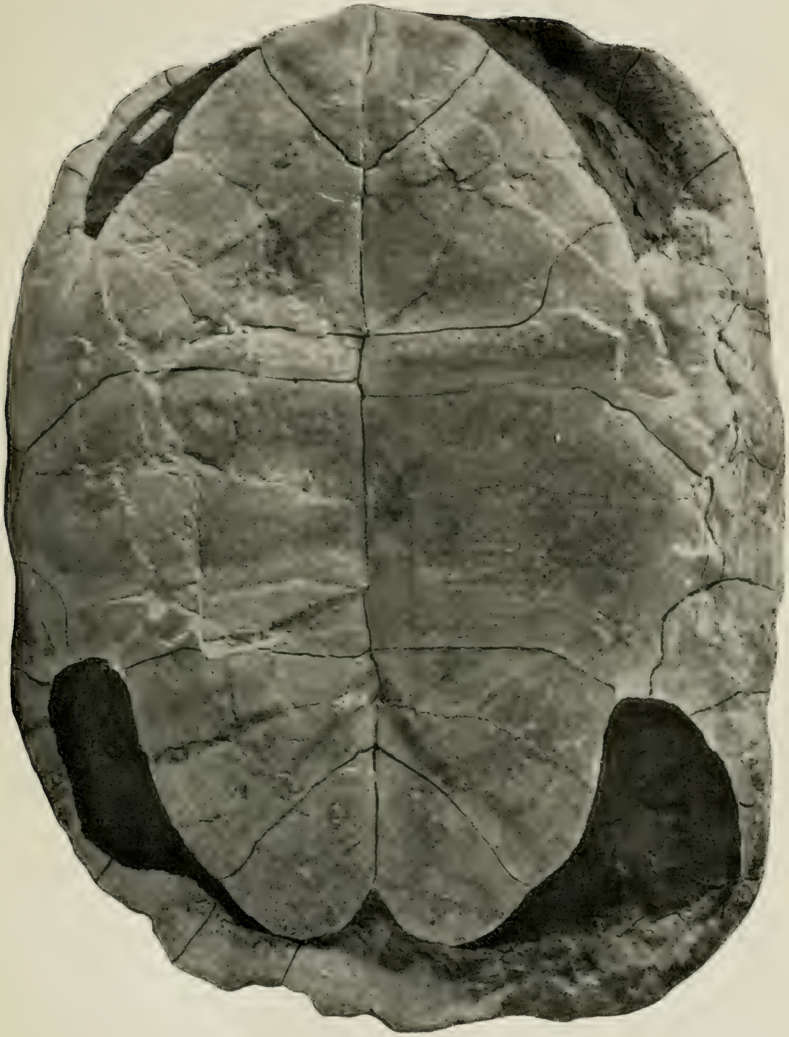
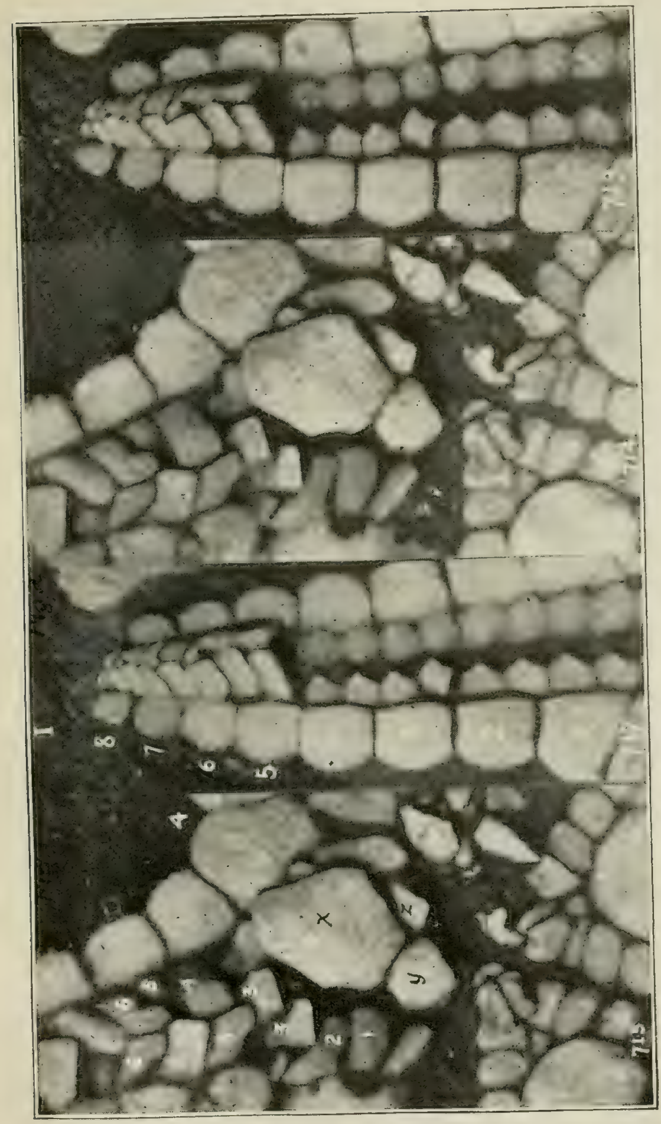




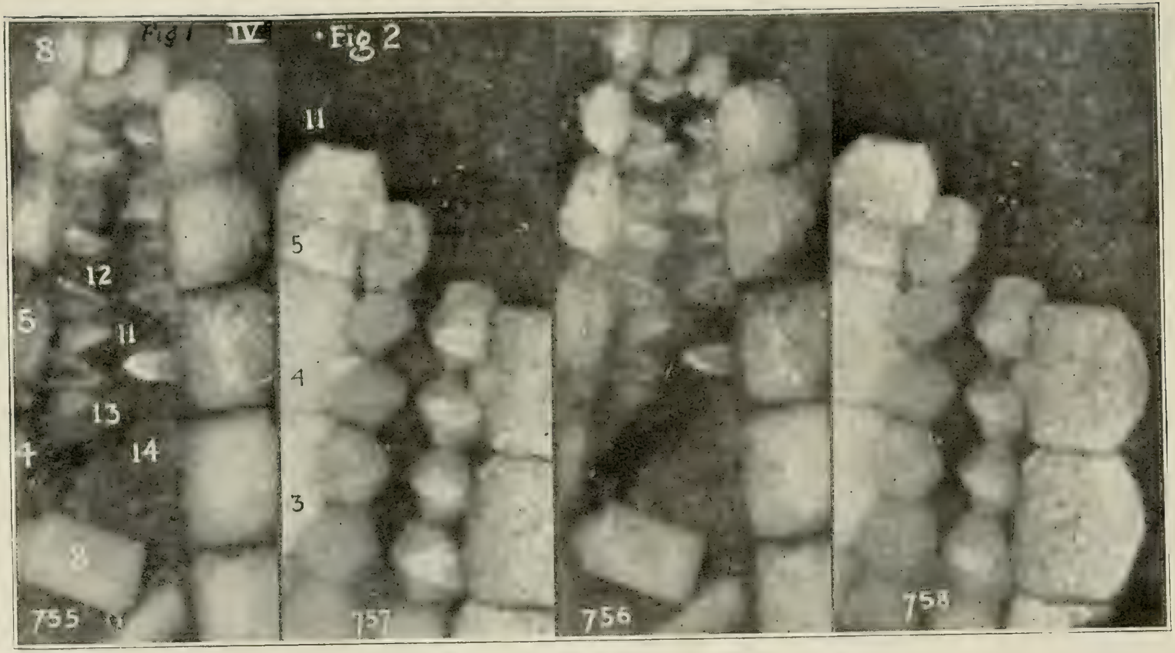








Details of *Protopalæaster narrawayi*, Hudson, under gum and enlarged about 9.5 diameters. The numbers next lower margin are those of the original negatives. Examine with a stereoscope to study in relief.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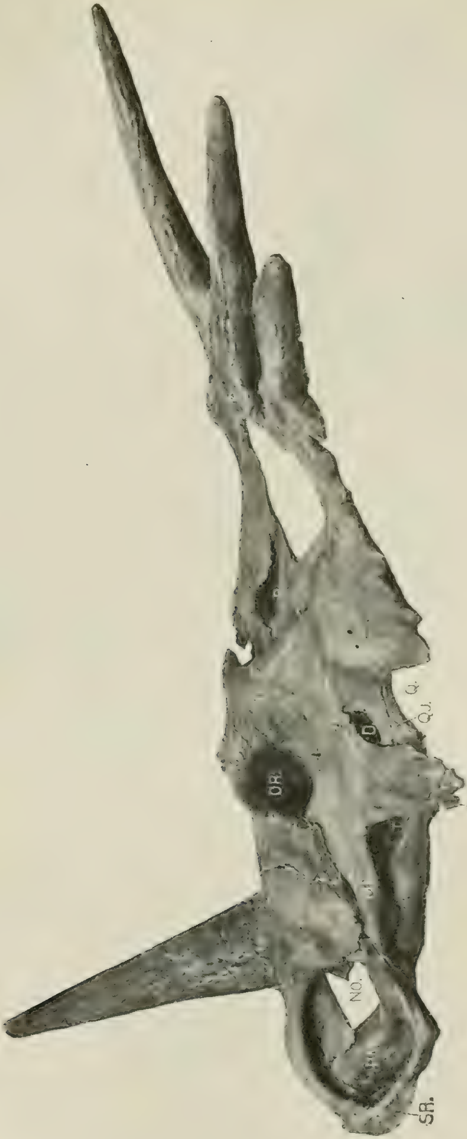
Details of *Protopalæaster narrawayi*, Hudson, under gum and enlarged about 19.5 diameters. Numbers 13 and 14 are wrongly placed. The former is at the position of the *tenth* epineural.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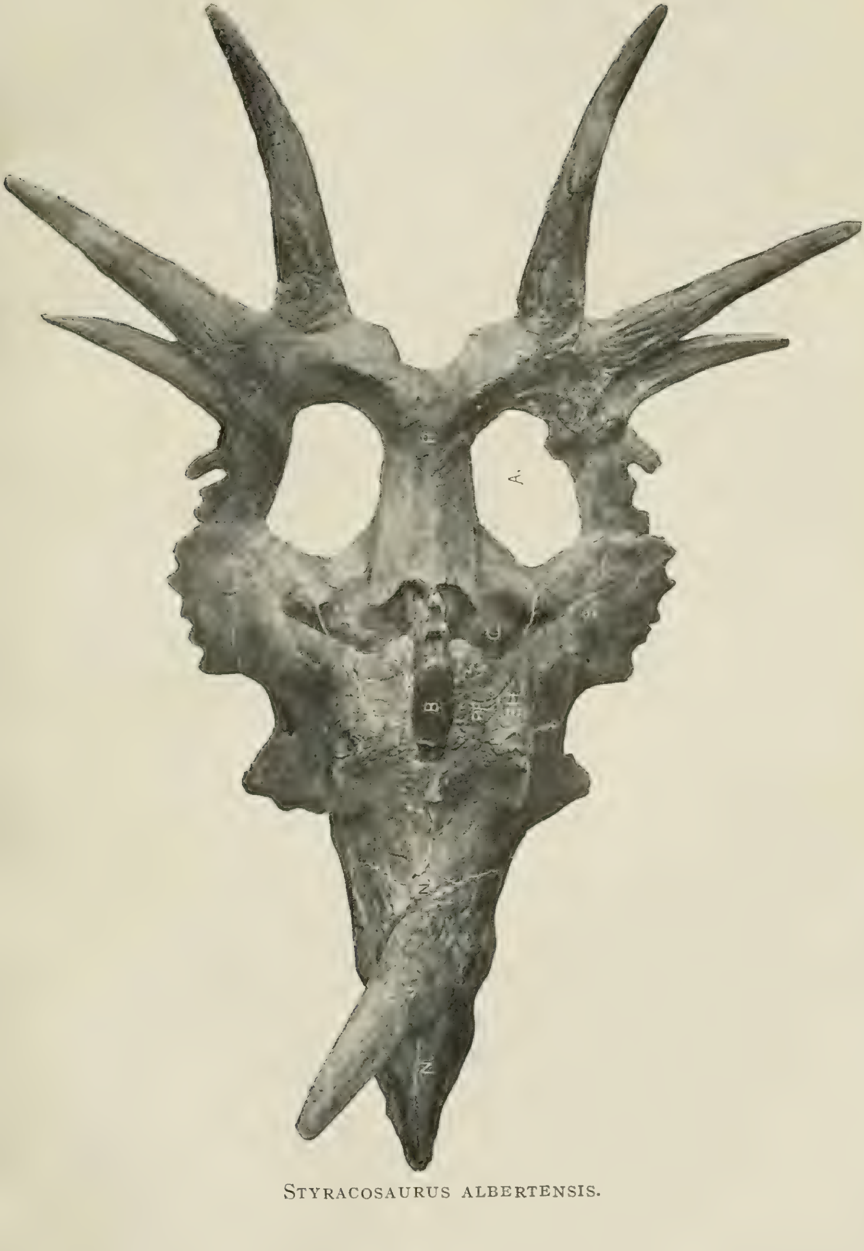

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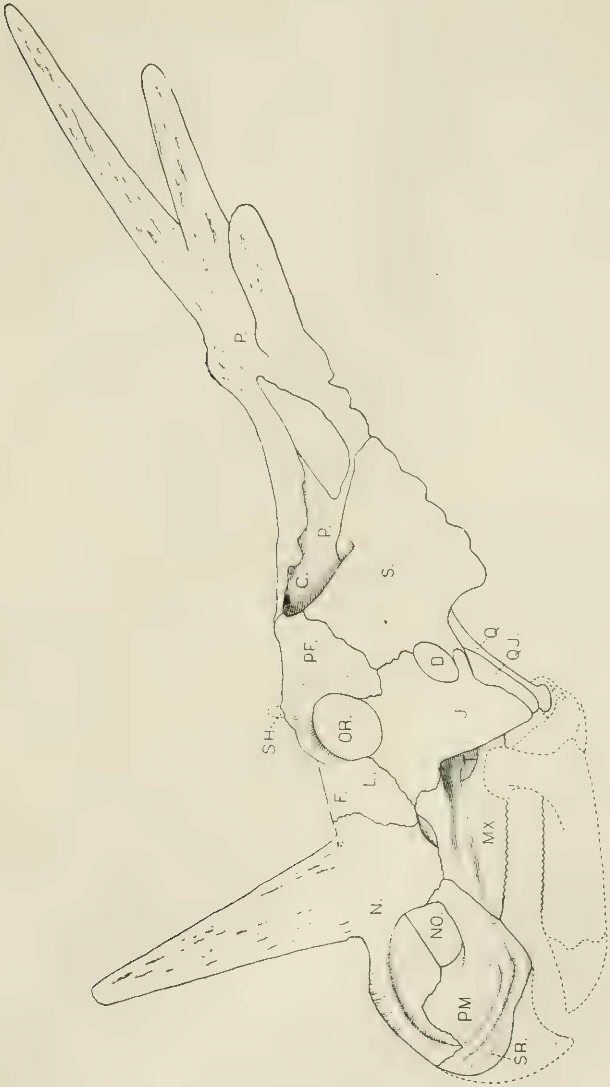
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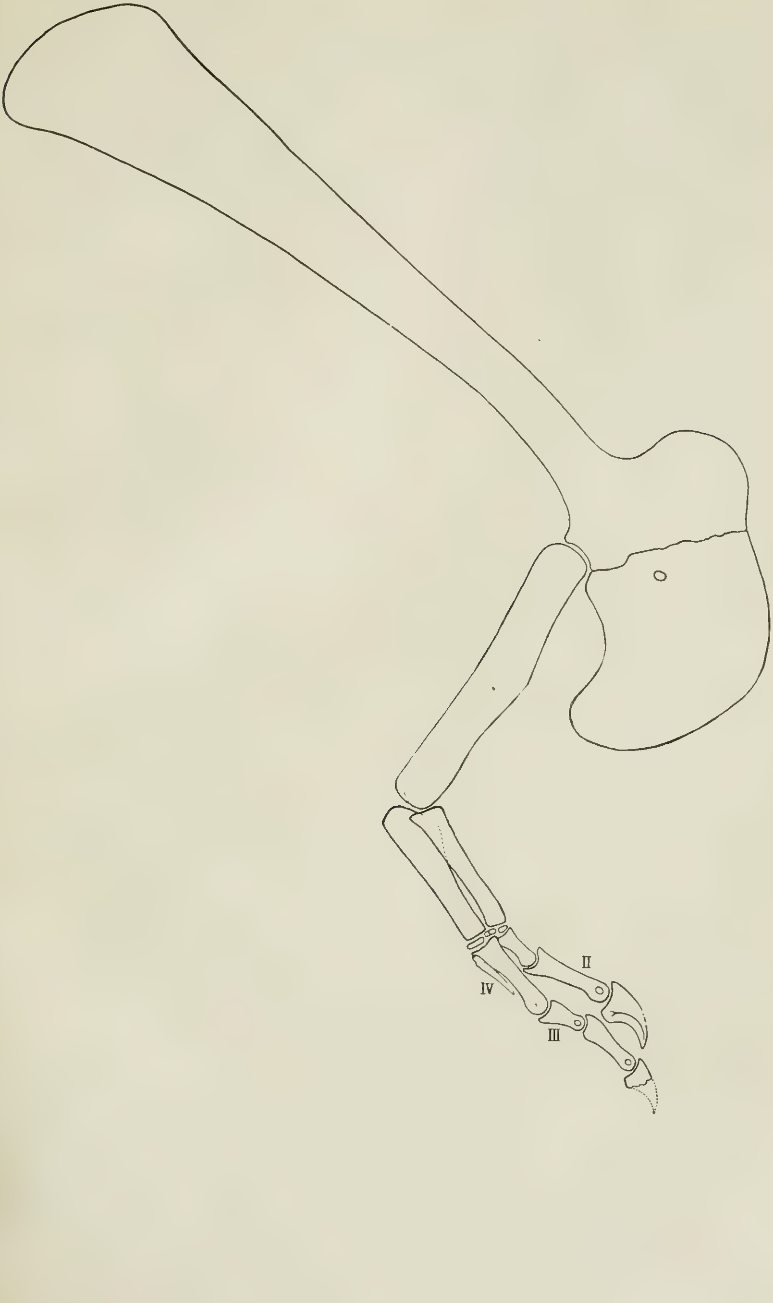
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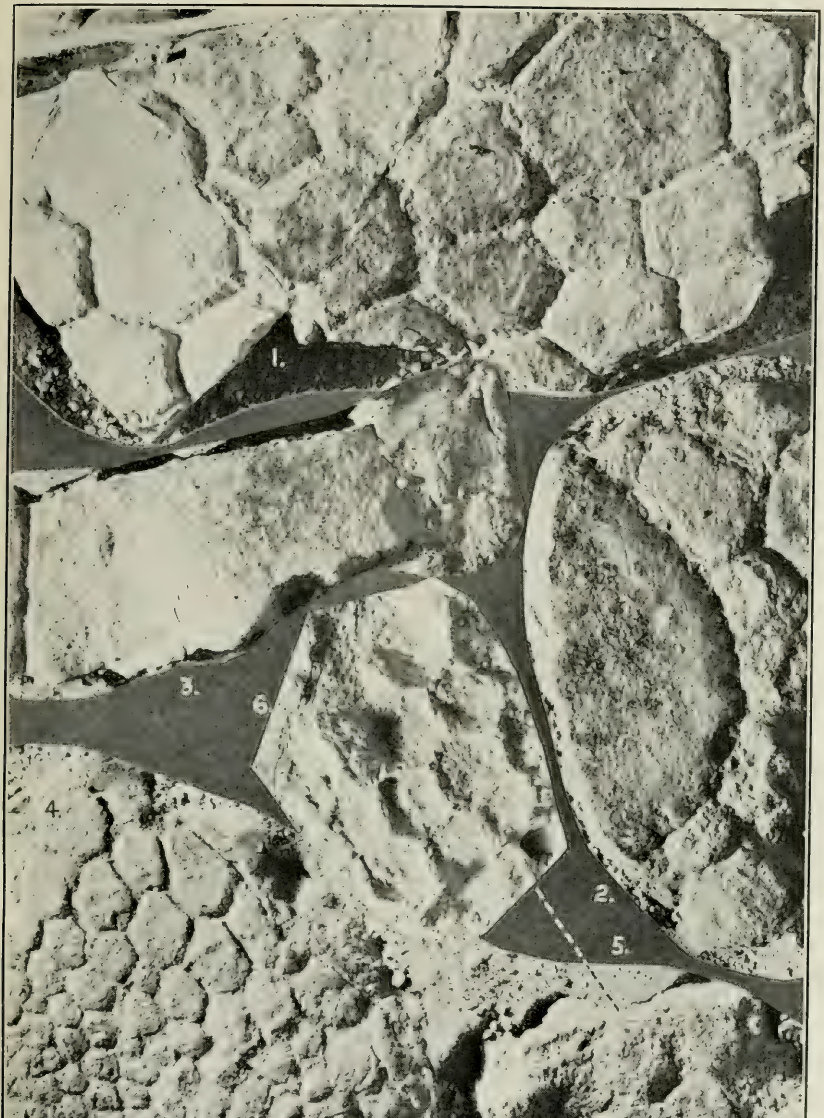
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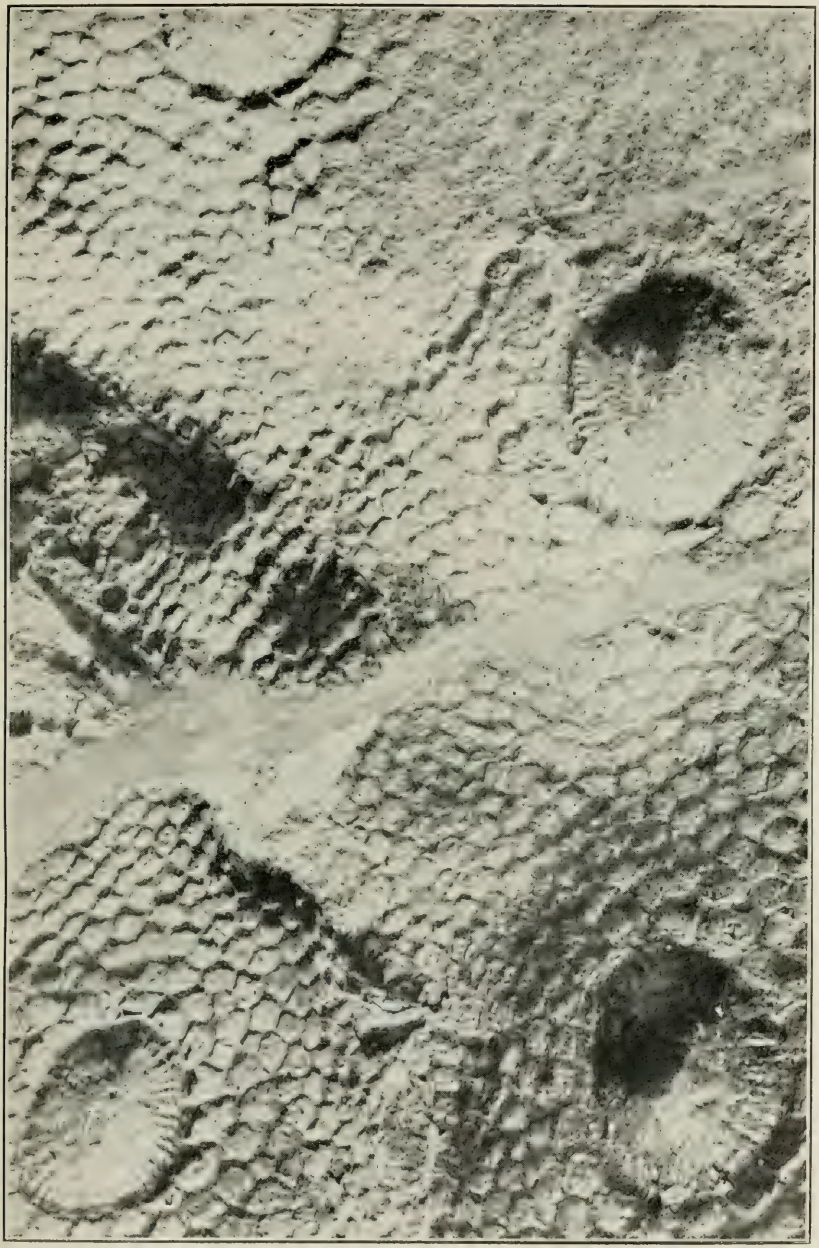

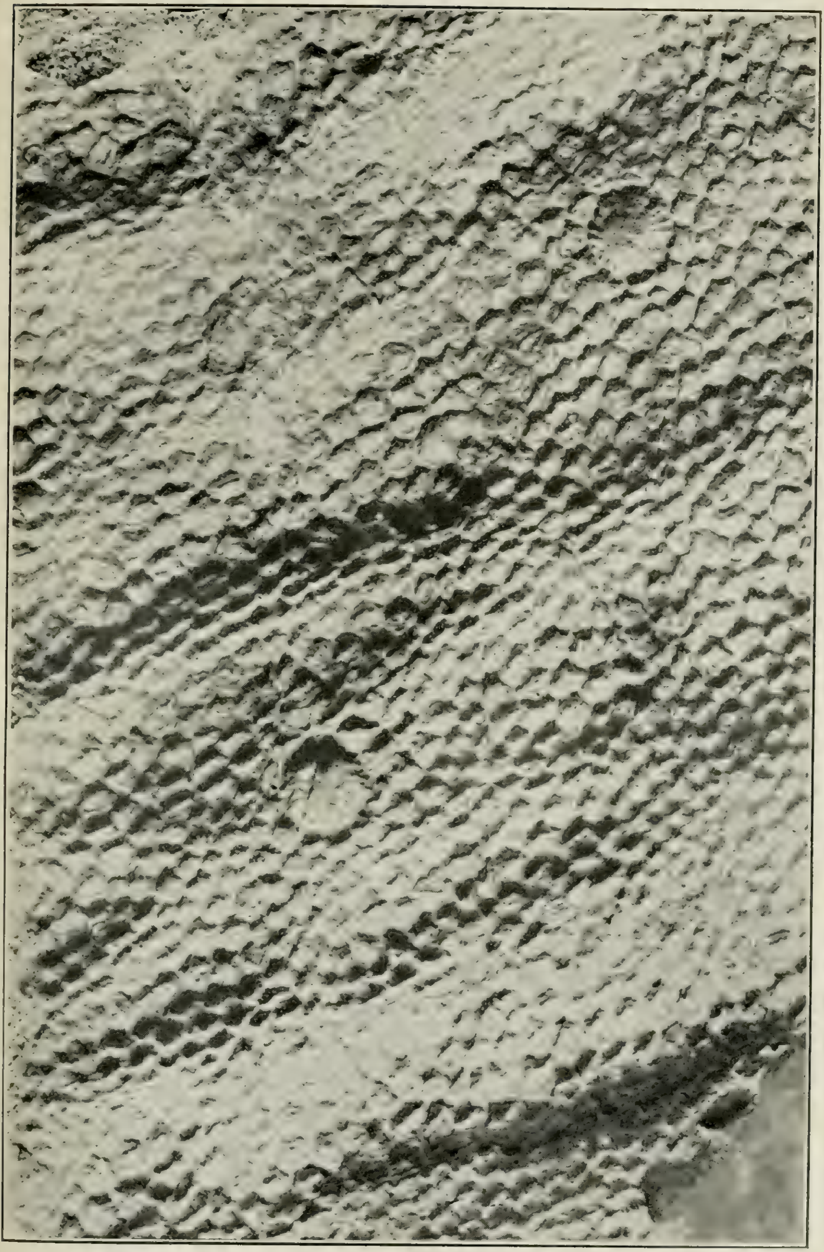

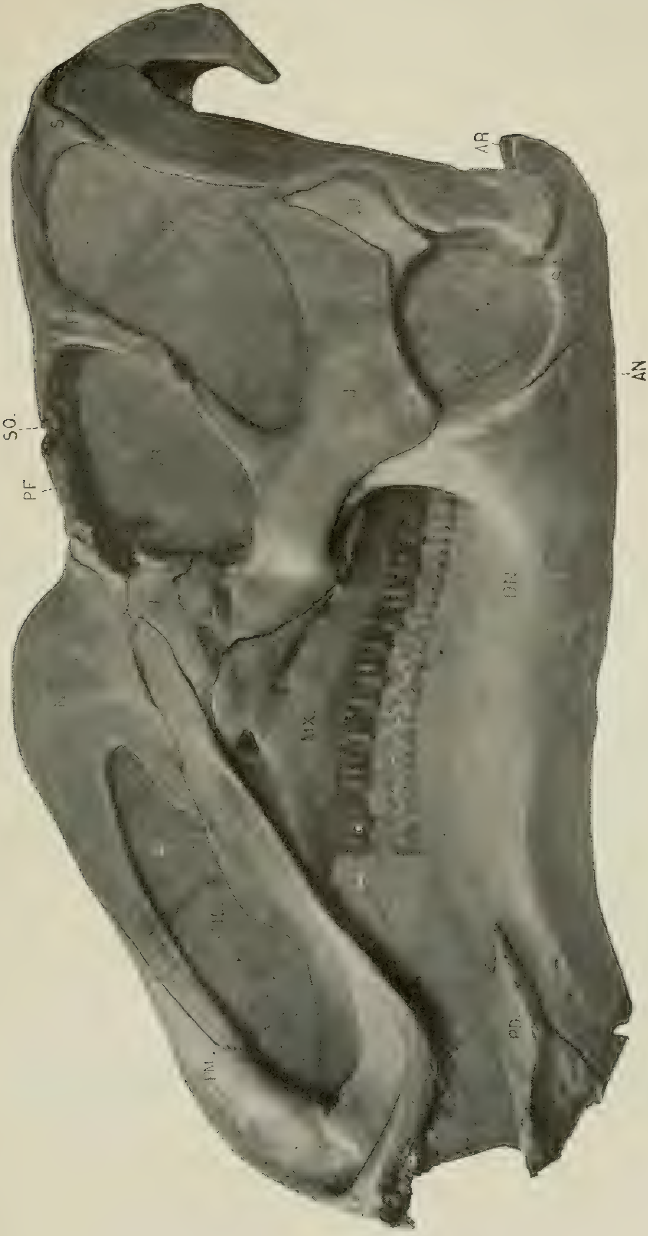
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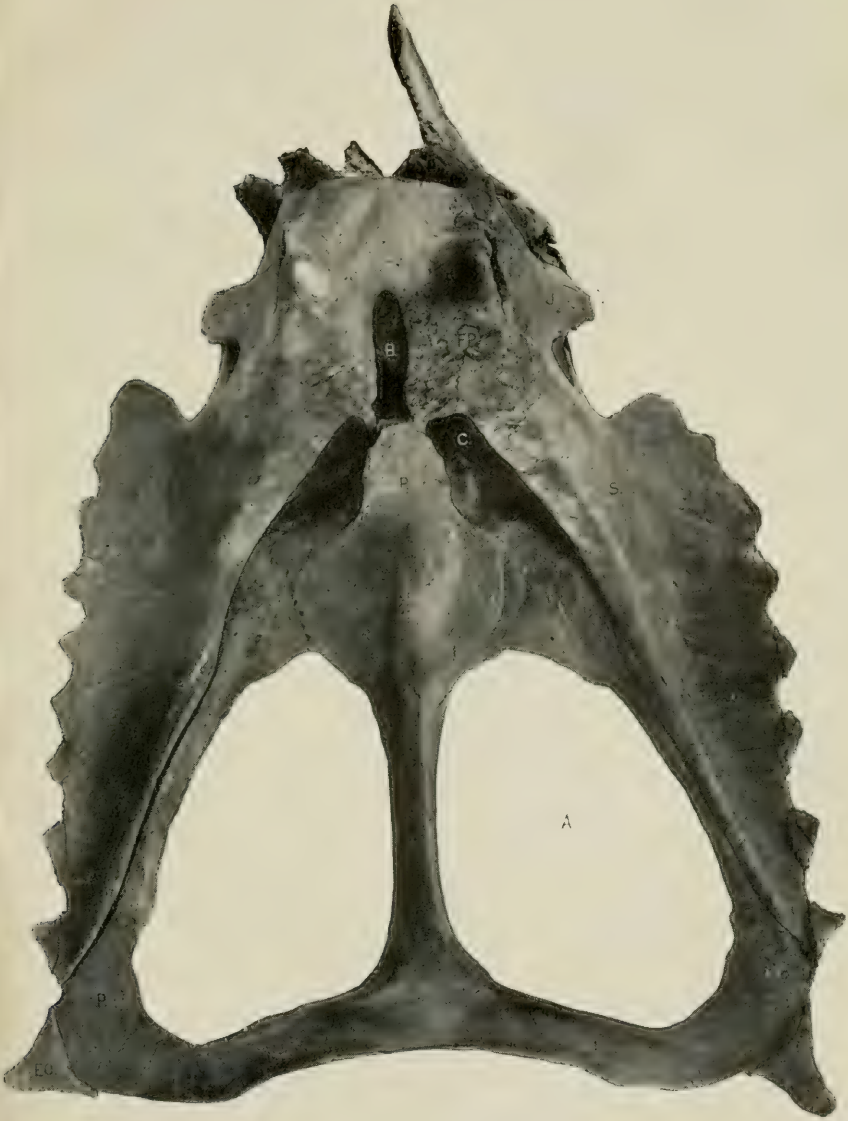
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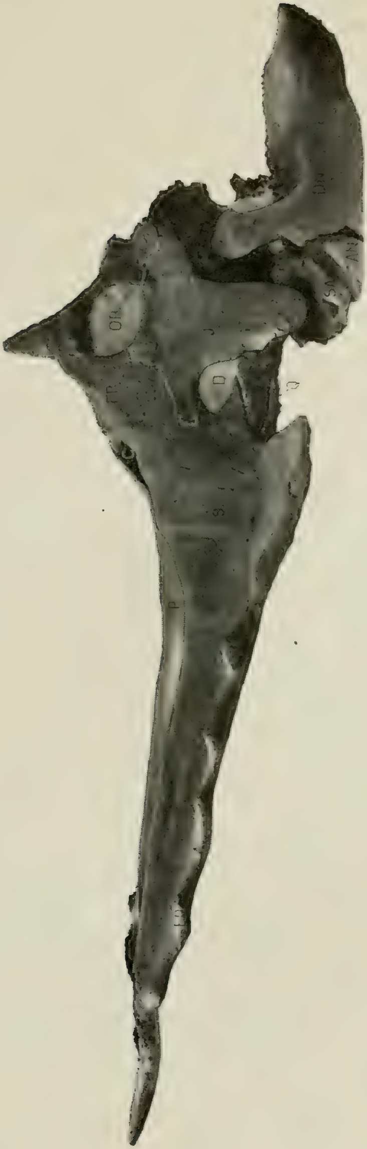
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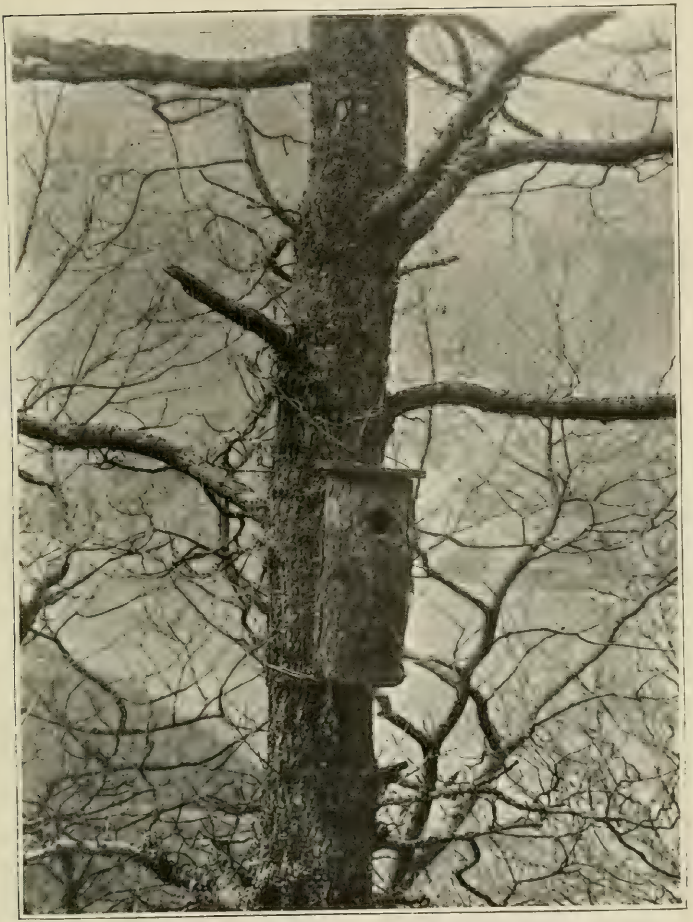
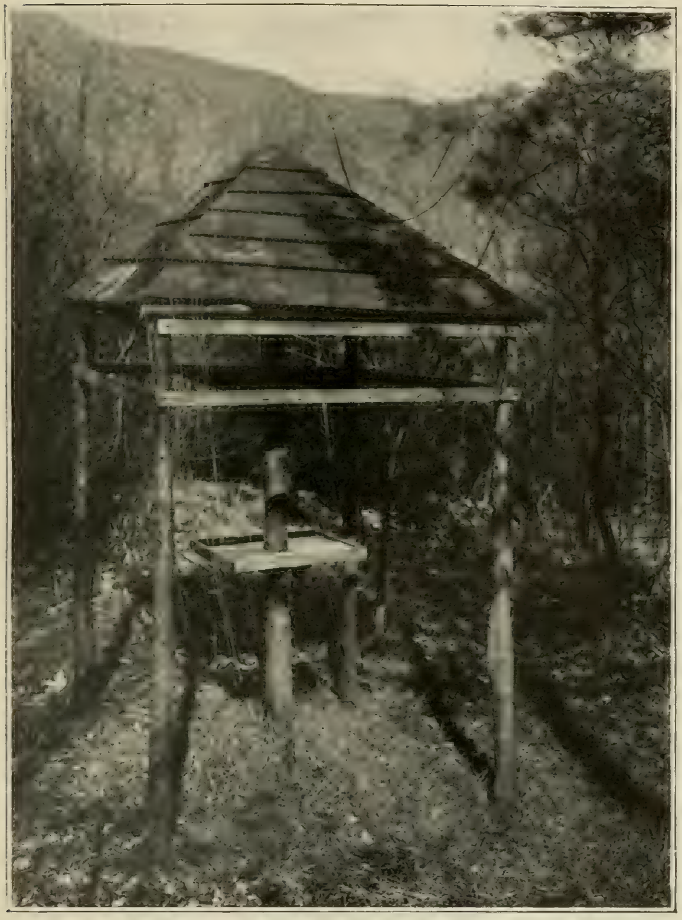
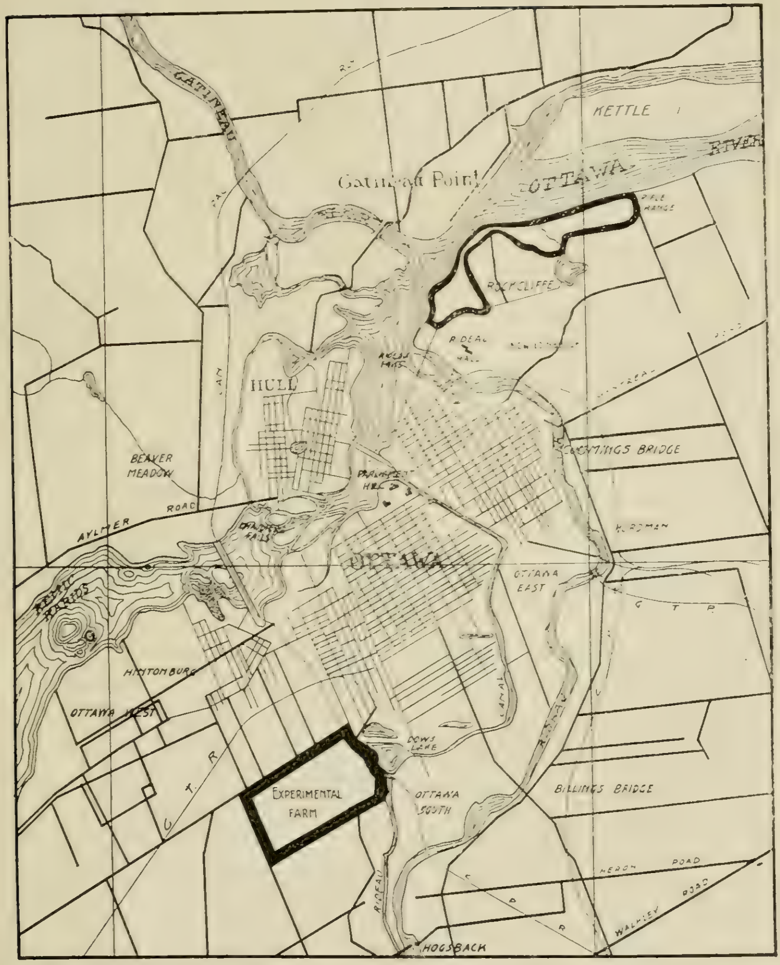


Nesting Box in use at Thirlmere, Cumberland, England.



Hessian Food-house; One of a Number Erected on the Manchester Corporation Waterworks' Estate, Thirlmere, Cumberland, England for the Winter Feeding of Birds.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BILLINGS BRIDGE
HERON ROAD
WALKLEY ROAD
RIDEAU
HOGSBACK

Map of Ottawa Showing the Location (Outlined in Black) of the two Bird Sanctuaries: Rockcliffe Park and the Experimental Farm.

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THE

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Being Volume XXX of the

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Eastham, J. W., *B.Sc.*
Eddy, E. D., *B.S.A.*
Eifrig, *Rev. Prof.* G., (Oak Park, Ill.)
Elford, F. C.
Evans, John D., *C.E.*, (Trenton, Ont.)
Evans, T. C., *D.V.Sc.* (Tor.)
Ewart, D.

Farley, F. L., (Camrose, Alta.)
Farr, Miss E. M., (Philadelphia).

Fenn, Miss L.
Ferrier, W. F., (Toronto).
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Fisher, *Hon.* Sydney A., *B.A.*
FitzHenry, W., (Myrtle, Man.)
Fleck, A. W.
Fleming, J. H., (Toronto).
Fleming, *Sir* Sandford, *K.C.M.G.*, *C.E.*, *F.R.C.I.*, *F.R.S.C.*
Forster, E. L. C., *M.A.*
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Fryer, J. R., *B.A.*
Fraser, Geo., (Ucluelet, B.C.)
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Fyles, Miss Winnifred

Gallup, A. H., (Saskatoon, Sask.)
Gibson, Arthur.
Gibson, J. W., *B.A.*
Godson, F. P., *B.A.*
Gorman, M. J., *LL.B.*
Gormley, L., (Arnprior, Ont.)
Grant, *Sir* J. A., *K.C.M.G.*, *M.D.*, *F.R.C.S. Edin.*, *F.R.S.C.*, *F.G.S.*
Grant, Mrs. E. C.
Grant, W. W., (New York).
Graham, W. L., *B.S.A.*
Grisdale, J. H., *B.Agr.*
Grist, Miss Mary L.
Groh, H., *B.S.A.*, (Preston, Ont.)
Gussow, H. T., *F.R.M.S.*

Halkett, Andrew.
Harcourt, Geo., (Edmonton, Alta.)
Harmer, Miss G., (Entwistle, Alta.)
Harrington, W. Hague.
Harrison, *Lt.-Col.* Edward.
Hart, F. C., *B.S.A.*, (Toronto).
Harvey, R. V., (Victoria, B.C.)
Hayes, J. A., (Sheffington, Que.)
Henry, J. K., (Vancouver, B.C.)
Herriot, W., (Galt, Ont.)
Hewit, H. O.
Hewitt, C. Gordon, *D.Sc.*, *F.E.S.*
Higgins, *Dr.* C. H.
Hobson, W. D., (Woodstock, Ont.)
Hodge, C. F., *Ph.D.*, (Worcester, Mass.)
Holmes, Miss A. S.
Hope, James.
Howes, E. A., *B.S.A.*
Houghton, J. A., (Bennington, Vt.)
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Hudson, H. F., *B.S.A.*
Hughson, W. G., *B.Sc.*

Irwin, *Lt.-Col.* D. T.

Jacobs, Miss C. M., (Hamilton, Ohio).
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James, C. C., *M.A.*, (Toronto).
James, L. E., (St. Thomas, Ont.)
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Janson, J. T., *B.Sc.*
Jenkins, S. J., *B.A.*
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Jennings, O. E., (Pittsburg, Pa.)
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Johnstone, Miss A.
Johnson, Geo. S., (Meaford, Ont.)

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Kingston, A. G.
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Lees, Miss V.
Lemieux, E. E.
Le Sueur, E. A.
Lewis, J. B., *C.E.*
Leyden, Miss M.
Lochhead, W., *B.A.*, *M.Sc.*, (Macdonald College, Que.)
Lloyd, *Prof.* F. E., (Montreal).
Lyman, H. H., *M.A.*, (Montreal).

McCready, *Prof.* S. B., (Guelph).
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McDougall, Miss J. C.
McElhinney, *Dr.* M. G.
McGill, A., *B.A.*, *B.Sc.*

McGillivray, H.
McInnes, Wm., *B.A.*
McMillan, H. R., *B.S.A.*, (Victoria, B.C.)
McMillan, G. O., *M.A.*
MacCraken, John I., *B.A.*
MacKay, A. H., *LL.D.*, *B.Sc.*, *F.R.S.C.*, (Halifax).
Macnamara, C., (Arnprior).
Macoun, *Prof.* John, *M.A.*, *F.L.S.*, *F.R.S.C.*, (Sidney, B.C.)
Macoun, J. M.
Macoun, W. T.
Malcolm, John, (Fergus, Ont.)
Mallock, G. S., *B.A.*
Malte, M. O., *Ph.D.*
Martin, D. A., (Lawson, Sask.)
Matthews, Miss Annie L.
Mason, A. E., (Vancouver, B.C.)
Megill, W. H. T., *B.A.*
Merrill, G. K., (Rockland, Me.)
Metcalfe, W.
Michaud, Geo., (Quebec).
Millen, Miss C., (Hull, Que.)
Miller, *Prof.* W. G., (Toronto).
Milne, Wm.
Mitchell, P. C., (Brandon, Man.)
Moore, W. H., (Scotch Lake, N.B.)
Morris, H. U.
Morton, B.
Munro, J. A., (Okanagan Landing, B.C.)
Murphy, John.

Narraway, J. E.
Nash, C. W., (Toronto).
Newcombe, C. F., *M.D.*, (Victoria, B.C.)
Newman, L. H., *B.S.A.*
Nicholls, A., (Sault St. Marie, Ont.)
Noble, J. W., (London, Ont.)
Nunnick, F. C., *B.S.A.*

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Oakely, Mrs. W. D.
Odell, W. S.
Orde, J. F.
Oberholser, H. C., (Washington, D.C.)

Patterson, A. M.
Phillips, *Rev.* E.
Phillips, P. B., (New York).
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Prince, *Prof.* E. E., *B.A.*, *F.L.S.*
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Rush, M. L., *B.A.*
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Saunders, W. E., (London, Ont.)
Scott, C. H.
Scott, Miss Mary McKay.
Scott, W., *B.A.*, (Toronto).
Scott, *Rev.* C. T., (Victoria, B.C.)
Seton, E. Thompson, (Coscob, Conn.)
Shannon, Frank, (Saskatoon, Sask.)
Shearman, F. J. W.
Shutt, F. T., *M.A.*, *F.I.C.*, *F.C.S.*' *F.R.S.C.*
Simpson, Willibert.
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Soper, John.
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Stewart, A. T., *B.A.*
Summerby, Wm. J., *M.A.*, (Russell, Ont.)
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Symes, P. B.

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Tuer, Miss Margaret, (Port Hope, Ont.)
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Venables, E. P., (Vernon, B.C.)
Victorin, Rev. Bro., (Longueuil, Que.)

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Walker, *Sir* Edmund, (Toronto).
Walker, E. M., *B.A.*, *M.B.*, (Toronto).
Walker, Bryant, (Detroit).
Wallace, J. S., (Toronto).
Wallis, J. B., (Winnipeg, Man.)
Warwick, F. W., *B.Sc.*, (Buckingham, Que.)
Watson, J. F.
Watterson, A. E.
Waugh, F. W.
White, Mrs. Annie G. H., (Toronto).
White, George R.
White, James, (Snelgrove, Ont.)
White, O. C., *B.S.A.*
Whyte, Miss Ida V.
Whyte, Miss Isabella.
Whyte, R. B.
Wickware, A. B., *V.S.*
Wight, E. C.
Williams, Miss M. B., *B.A.*
Williams, J. B., (Toronto).
Williams, M. Y.
Willing, T. N., (Saskatoon, Sask.)
Wilson, Morley E.
Wilson, W. J., *Ph.B.*
Winchester, H. S.
Wintenberg, W. J.

Young, A. N.
Young, C. H.

Ziemann, Arthur.

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GREENE, DR. E. L., United States National Museum, Washington ,D.C.
HILL, ALBERT J., *M.A.*, *C.E.*, New Westminster, B.C.
HOLM, THEODOR, *Ph.D.*, Brookland, Washington, D.C.
MERRIAM, DR. C. HART, Washington, D.C.
WICKHAM, PROF. H. F., Iowa City, Iowa, U.S.

SATURDAY SPRING EXCURSIONS, 1914.

The following spring excursions have been arranged by the Excursions Committee:—

May 2—Rockcliffe.
“ 9—Above the Chaudiere Falls—north shore Ottawa River.
“ 16—Britannia.
“ 23—Ironsides.
“ 30—Leamey's Lake.
June 6—Rideau Canal by motor boats.
“ 13—Stittsville.
“ 20—Fairy Lake *via* Chelsea Road.
“ 27—Experimental Farm.

ANDREW HALKETT,
Chairman of Committee.

THE OTTAWA NATURALIST

VOL. XXVIII. OTTAWA, APRIL, 1914 No. 1.

ANNUAL REPORT OF THE OTTAWA FIELD-NATURALISTS' CLUB, 1913-14.

On the completion of the thirty-fourth year of the existence of The Ottawa Field-Naturalists' Club, the Council begs to present a summary of the work undertaken and accomplished during the past season.

Eight meetings of the Council have been held. The standing committees, the editor and associate editors of THE OTTAWA NATURALIST, the librarian and the excursion leaders were appointed at the first meeting.

The membership of the Club is now 311. During the year 14 members were elected, 11 resigned, 7 were removed from the list for non-payment of dues and there was one death, making a total loss of 19.

The Club was represented at the Jubilee Meeting of the Entomological Society of Ontario, which was held at the Ontario Agricultural College, Guelph, August 27th-29th, 1913, by Mr. Arthur Gibson, and at the meetings of the Royal Society, held in Ottawa, by the President, Mr. L. H. Newman.

The usual work under the direction of the various committees has been conducted along much the same lines as followed in previous years, and some new field operations have been commenced from which much is expected. Steps are being taken to interest the proper authorities in the preservation, in the natural condition, of certain areas in the Ottawa district which are especially valuable for natural history study, instead of allowing them to be subdivided into building lots.

PRESERVATION OF BIRD LIFE.

A prominent feature of the Club's work this year has been the attention given to the preservation of bird life, as a result of which bird sanctuaries will be established at Rockcliffe Park and the Experimental Farm. In the Rockcliffe sanctuary 250 nest boxes will be put up this spring and at the Experimental Farm 160, under the direction of the Club. The question of protecting birds, the economic value of certain common species and the proposal of the Club for the protection of the native birds around Ottawa were dealt with at one of the winter lectures by Dr. C. Gordon Hewitt, Dominion Entomologist. An abstract of this address was printed in the March number of THE OTTAWA NATURALIST.

THE OTTAWA NATURALIST.

Under the direction of the Publications' Committee, THE OTTAWA NATURALIST, the official organ of the Club, has appeared regularly during the year and Volume XXVII is now complete. Mr. Arthur Gibson has continued to edit it. The ten numbers issued (two of which were double numbers) comprise 180 pages, in addition to which 23 plates appeared. This large number of plates adds very much to the appearance of our journal, and, of course, increases its value very materially.

The following are the most important papers which have appeared in the volume:—

Notes on the Occurrence of Interesting Forms of Cyperaceae in Quebec. By Bro. Victorin, Longueuil, Que.
Preliminary List of Ottawa Sphaeriidae. By F. R. Latchford.
The Manus in a Specimen of Trachodon from the Edmonton Formation of Alberta. By L. M. Lambe.
The Shade Trees of Ottawa. By E. H. Blackader.
Useful Wild Plants of Canada. By J. W. Eastham.
Description of a New Species of Testudo, and of a Remarkable Specimen of Stylemys nebrascensis from the Oligocene of Wyoming, U.S.A. By L. M. Lambe.
The Broad-striped Skunk. By Norman and Stuart Criddle.
Does the Type of Protopalaeaster narrawayi Present an Oral or Aboral Aspect. By G. H. Hudson.
The Haunts of Some of Our Native Ferns. By A. Cosens.
On the Genera of the Eodiscidae. By P. E. Raymond.
A New Genus and Species of Ceratopsia from the Belly River Formation of Alberta. By L. M. Lambe.
New and Otherwise Interesting Lichens from Vancouver Island and the Rocky Mountains. By G. K. Merrill.
Some Rare Cases of Albinism in Animals. By E. E. Prince.
On the Fore-limb of a Carnivorous Dinosaur from the Belly River Formation of Alberta, and a New Genus of Ceratopsia from the Same Horizon, with Remarks on the Integument of Some Cretaceous Herbivorous Dinosaurs. By L. M. Lambe.

On Gryposaurus notabilis, a New Genus and Species of Trachodont Dinosaur from the Belly River Formation of Alberta, with a Description of the Skull of Protorosaurus belli. By L. M. Lambe.

Notes on the Apothecial Stage of Sclerontinia cinerea in Ontario. By J. E. Howitt.

The Protection of Birds In and Around Ottawa. By C. Gordon Hewitt.

The Library.

Several new publications have been added to our exchange list during the year, some of which are valuable contributions to current scientific literature. There has been quite a demand for back numbers of THE OTTAWA NATURALIST, and in most cases the requests were for a number of volumes. The most important exchange was a shipment of 10 volumes to the Natural History Museum of Hamburg, Germany, for which we received a number of volumes of their Society Bulletin, which is an excellent one.

The Club Library at present contains a number of extremely valuable books, bulletins and periodicals, which, at present, are little used, owing to the lack of an index. It is hoped, however, that an arrangement will soon be made whereby a suitable cataloguing of the exchanges will be maintained.

Excursions.

The excursions arranged for by the committee in charge were all well attended, and much interest was taken in local natural history. The work accomplished at the various outings has been reported in THE OTTAWA NATURALIST. The following is the list of excursions held:—

Spring and Summer Series:

May	3	Rockcliffe and McKay's Lake.
	10	Leamy's Lake
	17	Britannia.
	31	Aylmer
June	7	Points along Rideau Canal by motor boats
	14	Stittsville.

Fall Series:

Sept.	20	Billings' Bridge.
	27	Experimental Farm.
Oct.	14	Beaver Meadow.

Lectures.

The series of lectures presented during the winter was also very successful. The attendance was good and the subjects discussed of much interest. The following is the programme as carried out:—

Nov. 25—Open meeting, with exhibits and addresses by members.
Dec. 9—The Old Iroquoian Religion and the Handsome Lake Reform (illustrated). By C. M. Barbeau, Assistant Ethnologist, Geological Survey.
Jan. 13—Forestry and Conservation (illustrated). By Dr. Clyde Leavitt, Commission of Conservation, Ottawa.
Jan. 27—The Shedding of Leaves, Flowers and Fruits (illustrated). By Dr. Francis E. Lloyd, Department of Botany, McGill University, Montreal.
Feb. 10—Protection of Birds In and Around Ottawa (illustrated). By Dr. C. Gordon Hewitt, Dominion Entomologist, Ottawa.
Feb. 24—Views in the Dominion Parks (illustrated). By A. Knechtel, Chief Forester of Dominion Parks, Ottawa.
Mar. 10—Mackenzie River Region (illustrated). By Charles Camsell, Geologist, Geological Survey, Ottawa.
Mar. 24—Annual Meeting and Presidential Address on the Breeding of Economic Plants. By L. H. Newman, Secretary, Canadian Seed Growers' Association, Ottawa.

THE BOTANICAL BRANCH.

There have been six meetings of this branch during the fall and winter. The first two were held at the residence of Mr. R. B. Whyte, one at the University Club Rooms and one at the residence of each of the following members: Messrs. J. M. Macoun, G. H. Clark and A. E. Attwood. Synopses of the meetings were published in THE OTTAWA NATURALIST.

In the fall it was suggested that the members should bring specimens of botanical interest to each meeting for exhibition and discussion, but the number presented has been smaller than was anticipated.

At the first meeting the members present gave brief accounts of observations which they had made during the summer. The subjects presented at the other meetings are as follows:—

Some Results of the Summer's Work. By Dr. M. O. Malte.
Some Conditions affecting Organic Progress. By C. J. Tully.
The Clay Belt of Northern Ontario. By G. H. Clark and Mr. Honeyman.
A Review of Some Recent Work dealing with the Phenomenon of Variation in Plants. By L. H. Newman.
The Wild Fruits of Canada. By W. T. Macoun.

THE ENTOMOLOGICAL BRANCH.

Several meetings of the Entomological Branch have been held during the winter now drawing to a close. The attendance at these meetings has been good and the discussions have been extremely interesting.

During the season of 1913 large collections of insects, particularly in the orders Hymenoptera and Diptera, were made, many additions being added to the local lists. The prospects are bright for successful field work during the approaching collecting season.

The tent caterpillars, which were referred to in our last report, were, also in 1913, the most abundant insects in the district. Although certain areas of forest lands, chiefly of birch and poplar, were again defoliated, the damage was not so widespread as that of 1912. The natural parasites and fungous diseases which control the tent caterpillars are increasing, and we do not expect to again see, for many years, such enormous outbreaks of these insects.

At the conclusion of the Club year, the balance on hand is $28.59.

For accommodation for lectures and Council meetings, the thanks of the Club are due to the management of the Carnegie Library, the Normal School and the Collegiate Institute, and to the press of the city for the free insertion of notices and the publication of reports of excursions and lectures.

Respectfully submitted,

E. D. EDDY, Secretary.

WINTER NOTES ON ALBERTA HAWKS AND OWLS.

There has been a noticeable absence this winter of the Great Gray Owl, American Hawk Owl and the Snowy Owl in this district. These birds are all irregular winter visitors, arriving from the North about the middle of November and remaining until the middle of March. Some winters they are comparatively plentiful, as many as one or two of each variety may be seen in a single day. In November, 1896, I counted a dozen Hawk Owls in a day's drive of thirty miles, while the following winter, very few, if any, were seen. Different reasons have been advanced for their irregular migration, the most likely of which is the supply of natural food. Hunters returning from the country away north of the Saskatchewan River say that the Rabbit is very plentiful this winter and this no doubt accounts for their not having to move South. I have never seen any of these birds in this locality in the summer.

3rd April, 1914. F. L. FARLEY, CAMROSE, ALBERTA.

TREASURER'S STATEMENT FOR YEAR ENDING 17TH MARCH, 1914.

RECEIPTS.

Balance from previous year		$ 9.79
Subscriptions:—		
Arrears	$ 39.00	
1913-1914	194.00	
1914-1915, in advance	31.00	
		264.00
Advertisements in OTTAWA NATURALIST		103.90
Authors' extras sold		225.31
Government Grant		200.00
		$803.00

EXPENDITURE.

Printing OTTAWA NATURALIST, Vol. XXVII, 10 Nos., including cover	$362.00	
Illustrations	152.47	
Authors' extras	120.69	
Miscellaneous printing: circulars, mailing envelopes, etc	17.88	
Postage on OTTAWA NATURALIST	28.34	
Editor	50.00	
		$731.38
Lecture expenses		26.89
Sundry expenses, postage, bank exchange, etc		16.14
Balance		28.59
		$803.00

W. T. MACOUN, Treasurer.

Examined and found correct,

J. BALLANTYNE, } Auditors.
E. C. WIGHT, }

MEMBERSHIP FEES, 1914-1915.

Subscriptions for the Club year beginning April, 1914, are now due and should be made payable to the new Treasurer, Mr. J. F. Watson, Central Experimental Farm, Ottawa.

ON A NEW GENUS AND SPECIES OF CARNIVOROUS DINOSAUR FROM THE BELLY RIVER FORMATION OF ALBERTA, WITH A DESCRIPTION OF THE SKULL OF STEPHANOSAURUS MARGINATUS FROM THE SAME HORIZON.*

BY LAWRENCE M. LAMBE, F.G.S., F.R.S.C., F.G.S.A.,
Vertebrate Palæontologist to the Geological Survey, Canada.

The osteological characters of one of the carnivorous dinosaurs of the Cretaceous are revealed in a wonderful manner by a nearly complete skeleton obtained last summer by the Vertebrate Palæontological expedition of the Geological Survey of Canada to Red Deer river, Alberta, where a magnificent collection of dinosaurian and other reptilian remains was obtained from the Belly River formation. The expedition was in charge of Mr. Charles H. Sternberg, and this skeleton was discovered by his son, Charles M. Sternberg, 3½ miles below the mouth of Berry creek (Steveville), on the south side of Red Deer river, near the prairie level.

The specimen includes the head, the greater part of the vertebral column, the pectoral and pelvic arches, one at least of the fore-limbs complete, both hind-limbs also complete, the ribs, and apparently the entire series of abdominal ribs. The cervical vertebræ appear to be missing, but as all of the sandstone matrix has not yet been removed, they, or some of them, as well as the other fore-limb, may yet be uncovered. The extreme end of the tail, back of the twenty-second caudal vertebra, was not found.

The mandible is present and all of the teeth, both upper and lower, are in place, giving the complete dentition. The writer has already published a short description of the fore-limb,** which has not hitherto been known in any of the Cretaceous carnivorous dinosaurs. Nor has a complete series of ventral ribs in any of these reptiles previously been discovered.

For the undescribed genus of Theropodous dinosaur, brought to light by this magnificent specimen, the name Gorgosaurus is proposed. The species may be called *libratus* in reference to the animal's probable well-balanced and easy gait.

GORGOSAURUS LIBRATUS, gen. et sp. nov.

Carnivorous dinosaur of large size, reaching a length of about twenty-nine feet; head narrow and moderately elongate;

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* Communicated by permission of the Director of the Geological Survey.

** The Ottawa Naturalist, Vol. XXVII, No. 10, January, 1914.

trunk compact; fore-limbs minute; hind-limbs long and robust; tail nearly half the total length of the animal, tapering, and with only a slight lateral compression. In the skull there is a large antorbital vacuity, preceded by a very small opening in the centre of a depressed area. No triangular alveolar plates on the inner sides of the jaws. A foramen present in the surangular, far back and near its upper border. No presplenial. Teeth trenchant, powerful, 4 premaxillary, 13 maxillary and 14 dentary. First tooth of the maxilla similar in shape and size to those of the premaxilla. Vertebræ slightly amphicoelous, concave on the sides and beneath; 2 cervico-dorsals, 11 dorsals, 5 sacrals, and about 34 caudals. Neural spines short throughout the vertebral column. Chevron bones short, beginning with the first caudal. Transverse processes of the caudal vertebræ decreasing in size to and ending with the 14th vertebra. Anterior zygapophyses of the posterior caudals greatly lengthened. Scapula longer than the fore-limb. Humerus twice the length of the ulna. Two digits, Nos. II and III, to the manus, of which the phalangeal formula is 2 II, 3 III, the terminal phalanges being claw-bones. Metacarpal IV represented by a proximal vestigial bone. Ilium elongate, plate-like, with a flat upper outline and rounded ends. Preacetabular part shorter than the hinder portion, of which both are strengthened on the outer surface by a prominent, overhanging flange running horizontally at midheight. Ischium terminating narrowly below. Pubis ending in a horizontally expanded foot, of which the posterior extension is the greater. Femur about the same length as the tibia. Metatarsals II, III and IV elongate, of which III, the longest, is nearly two-thirds the length of the femur. Metatarsal I represented distally by a short vestigial bone, and metatarsal V represented in a similar manner proximally. Four clawed digits to the pes, viz.: Nos. I, II, III and IV, of which the phalangeal formula is 2 I, 3 II, 4 III and 5 IV. Ventral ribs composite, sixteen in number, overlapping at the longitudinal mid-line of the body, and bearing distally slender, closely applied supplementaries.

Gorgosaurus libratus, apart from its dentition, is remarkable for the extreme shortness of the fore-legs and the great length of the hind ones. The long, narrow ilium rises slightly above the short sacral spines, and, in addition to the horizontal flanges, already mentioned, there are two small strengthening buttresses running upward from the centre of the acetabular border. The length of the metatarsals is surprising. The close application of the vestigial distal end of metatarsal I to metatarsal II is indicated by a slightly concave surface on the latter bone, which gives digit I a forwardly rather than a backwardly directed position in the foot. The vestigial proximal end of metatarsal V is in place in each leg, recalling to mind a similarly reduced bone in *Ornithomimus altus*, Lambe, also from the Belly River formation of Alberta.

Each abdominal rib consists of two well ossified, flattened lengths, which overlap at their inner ends. Outwardly, each lateral half is slightly grooved on its front margin for the reception of a slender rod-like bone (supplementary), which lies closely against the rib and projects but slightly beyond its outer end.

The four premaxillary teeth are remarkably long and slender, with a keel on each side of a slightly convex inner or lingual surface. They are latterly compressed to a slight extent, evenly rounded in front, with their fore and aft diameter a little greater than their breadth. The first or anterior tooth of the maxilla is similar to the premaxillary teeth, in which respect Gorgosaurus differs from other known genera of Cretaceous carnivorous dinosaurs. The other maxillary teeth are long and powerful, of the Megalosauroid type, with two serrated keels, one along the front edge, the other behind. In the second maxillary tooth the anterior keel in descending passes slightly toward the inner side of the crown, and this is seen in a lessening degree in the next two or three succeeding teeth. A similar slight variation is seen also in the more anterior teeth of the dentary.

The chevron bones are intervertebral, but with a greater surface of attachment to the front vertebra of the two, The more anterior ones are bent slightly backward from their mid-length. This angulation in succeeding ones becomes more pronounced until the lower edge of the distal half is parallel to the longitudinal axis of the tail. By a gradually increased development and prolongation forward of the anterior angulation at the mid-length of the bone, a "meat-chopper" shape is attained and adhered to with a gradual diminution in size, more apparent in the depth of the bone than in the length of its "foot."

The long and slender anterior teeth (premaxillary and first maxillary) of Gorgosaurus are very different in shape from the robust supposed anterior teeth of *Deinodon horridus* of Leidy. In all the large Cretaceous carnivorous dinosaurs, the majority of the teeth, apart from the more anterior ones, are remarkably similar in the different genera and do not afford data for generic distinctions.

Another large form of carnivorous dinosaur, having supporting alveolar plates on the inner sides of the jaws, occurs in the Belly River formation of Alberta and is represented in the collection of 1913.

MEASUREMENTS.

	Feet.	Inches.
Total length of specimen (estimated)	29	2
Skull, length to occipital condyle (approx)	3	2
" depth to lower border of maxilla, through middle of antorbital opening	1	0
" depth to lower border of dentary, through middle of same opening	1	9¾
Mandible, length of	3	2¼
Third premaxillary tooth,		
Length below alveolar margin		2
Breadth at midlength		0⅜
First maxillary tooth,		
Length below alveolar margin		1⅞
Breadth at midlength		0⅜
Second maxillary tooth,		
Length below alveolar margin		2½
Fore and aft diameter		0⅞
Transverse diameter		0⅝
Maxillary tooth, longest (6th), length below alveolar margin		3⅞
Dentary tooth, longest (5th), length above alveolar margin		2⅝
Cervical vertebræ (atlas, axis, 7 cervicals and 2 cervico-dorsals), estimated length	4	4
Dorsal vertebræ with sacrum (11 dorsal, 5 sacral)	7	6
Caudal vertebræ, 1st to 22nd, both inclusive	10	4
" " 23rd to 34th, both inclusive (estimated)	3	10
Scapula with coracoid, length	3	5
Humerus, length		12¾
Ulna, length		6½
Radius, length		6⅛
Ilium, length (antero-posterior)	3	3¼
Ilium, height above lower end of ischial peduncle	1	2
Ischium, length	2	8¾
Pubis, length	3	3¼
Pubis, fore and aft length of foot of	1	10
Femur, length	3	4¼
Tibia (including astragalus), length	3	4

Tibia, length	3	3
Metatarsal, I, length		4½
“ II, “	1	9½
“ III, “	2	0½
“ IV, “	1	10
“ V, “		8½
Digit I of pes, length		8
“ II “ “	1	4¾
“ III “ “	1	8
“ IV “ “	1	4½
1st Dorsal vertebra, length of centrum of		3½
3rd “ “ “ “		4
2nd Rib, length	3	9
Posterior sacral vertebra, length of centrum of		6½
1st Caudal vertebra, length of centrum of		6
“ “ “ height of anterior end of centrum of		7½
5th Caudal vertebra, length of centrum of		6
“ “ “ height of centrum of, × neural spine		11½
“ “ “ length of chevron bone of		8
12th “ “ length of centrum of		5¾
“ “ “ height of anterior end of centrum of		3½
22nd “ “ length of centrum of		4⅜
“ “ “ height of anterior end of centrum of		1⅞
“ “ “ fore and aft length of foot of chevron bone of		4
5th Abdominal rib, length of lateral half of	2	1¼
Outer supplementary of same, length of		9¾

STEPHANOSAURUS, gen. nov.

This genus is established for the reception of the species from the Belly River formation of Alberta, originally described, under the name of *Trachodon marginatus*, by the writer in 1902* from a ramus of a lower jaw and a maxilla, and from the remains of one individual. With the species were provisionally associated other elements, notably a slender footed-ischium, which associations have since been proved to be correct by further material included in the collection of 1913 from the Belly River formation of Red Deer river. These additional remains, discovered by

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*Contributions to Canadian Palæontology, Vol. III (quarto), pt. II.

Mr. Charles H. Sternberg, are of two individuals to which the writer has lately referred† in describing the integument of the species. With one of these specimens the skull reproduced in plate I is preserved. Part of another skull (collection of 1913), found separately, assists in elucidating the characters displayed by the more perfect skull, and provides additional evidence regarding some of those elements to whose great development is mainly due the surprising shape of the head of this species.

The skull of Stephanosaurus rises to a great height in front of and above the eye opening. In recently describing Gryposaurus, also from the Belly River formation of Alberta, the writer commented on the anterior depth of the skull occasioned by the height to which the nasal rose. In the skull of Stephanosaurus, however, the height attained by the nasals is proportionately twice as great as in Gryposaurus; the depth of the skull above its midlength is equal to its total length. Viewing the skull from the side, the facial outline is sigmoid, at first concave, ascending rapidly from the front until it is vertical, whence it continues upward and reaches a point directly above by an even convex curve; this, the highest point preserved in the specimen, is vertically above the midlength of the skull. The general slope of the head behind is rapidly downward to the squamosal, but as this part of the specimen is imperfect, the exact outline is unknown. The almost vertical quadrate and the sinuous horizontal contour of the slender mandible below complete the profile of the head.

The orbit is small and its centre is below the midheight of the skull.

The enlargement of the skull in front of and above the orbit is due to the great development mainly of the prefrontal and nasal bones, the latter of which rises upward in front of the prefrontal and passes backward over it and beyond it. This extension of the nasal beyond the upper limit of the prefrontal appears to be supported from below by the frontal, although this last bone has not been satisfactorily recognized. Above the prefrontal and the supposed frontal, the nasal points almost directly upward. In the specimen its upper termination has been broken off, but it probably formed with the other nasal a stout spine somewhat of the shape suggested by the dotted outline in the figure.

The prefrontal is a large triangular bone with its base resting for the most part on the lachrymal, which latter is long and narrow, meets the jugal below, and posteriorly enters largely into the formation of the orbital rim.

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† The Ottawa Naturalist, Vol. XXVII, No. 10, January, 1914.

By referring to the figure it will be seen that the maxilla, the jugal, the quadrato-jugal, the quadrate, and the mandible have much the same proportions as in Trachodon. The jugal is small, but it has the general shape characteristic of this element in all known members of the Trachodontidæ.

Anteriorly, the premaxilla is somewhat depressed, but laterally much expanded. Its upper surface, next to the median line of the head, is continued in a curve outward anteriorly and backward laterally as a marginal area enclosing a wide depression in advance of the long and narrow nasal opening. In the specimen, the outermost portion of the laterally expanded premaxilla is crushed down. The nasal opening is enclosed above by the nasal and below by a backwardly directed extension of the premaxilla. This extension, or lower limb, of the premaxilla passes along the upper front surface of the maxilla and abuts against the prefrontal. Above, posteriorly, it unites with the nasal behind the nasal opening in a short sutural contact. It is not known how far forward the nasal extends, as its suture with the premaxilla in front has not been detected.

The squamosal is preserved in part, as shewn in the figure. The postfrontal is probably represented toward its anterior end, but here its limits are not recognized, and posteriorly the bone is imperfect. As in other members of the Trachodontidæ, it no doubt contributed to the formation of the postorbital bar.

The orbital opening is narrowly elliptical, with its longer diameter directed obliquely downward and forward. It is more than twice as long as wide. The lateral temporal fossa is larger than the orbit and is also longer than wide, with a similar obliquity of length.

Detailed descriptions, with illustrations, of the maxilla, the mandible, the teeth, the ischium, the pubis, and the principal bones of the fore- and hind-limbs of *Stephanosaurus marginatus* were published when the writer established the species in 1902. The characters of the integument are known from the writer's recent description (op. cit.).

The nearest approach to Stephanosaurus is Saurolophus of Brown from a higher horizon of the Cretaceous of Alberta (Edmonton formation). In this latter genus the facial slope of the skull is about midway between that of Stephanosaurus and Trachodon. The upwardly directed nasal spine of Stephanosaurus may have heralded the backwardly sloping nasal crest of the later Edmonton dinosaur. The two genera appear to be closely allied and in both the footed form of ischium is present.

EXPLANATION OF PLATE I.

Left lateral aspect of skull of *Stephanosaurus marginatus*: one-fifth the natural size.

Abbreviations.—*D*, lateral temporal fossa; *DN*, dentary; *J*, jugal; *L*, lachrymal; *MX*, maxilla; *N*, nasal; *NO*, nasal opening; *OR*, orbit; *PD*, predentary; *PF*, prefrontal; *PM*, premaxilla; *Q*, quadrate; *QJ*, quadrato-jugal; *S*, squamosal; *SA*, surangular.

THE LONDON BIOLOGICAL CLUB.

This club, which was formed on February 6th last, has twenty chartered members. It is the intention to hold monthly meetings and conduct field excursions. On March 6th, Dr. Hill, of the Institute of Public Health, gave an address on "Life", and on April 3rd Dr. Woolverton delivered a lecture on "The Mammoth Cave".

Recently the club presented a memorial to the Honourable Minister of Game and Fisheries, Toronto, which called attention to many native birds which have become seriously depleted in numbers, chiefly owing to shooting by sportsmen and others. Direction was drawn to the scarcity of quail in certain localities and the hope expressed that continuous protection be given so that the birds would have every chance to recover, in time, their former numbers. Other birds mentioned were the Eagle, Fish Hawk and Great Blue Heron, which have now become exceedingly rare. Many of the beneficial smaller birds are also in need of protection. In the opinion of the club, the easiest way to increase the amount of protection given by the present laws is to enact and enforce a license for all firearms except military rifles, which would prevent a great deal of the thoughtless slaughter at present carried on.

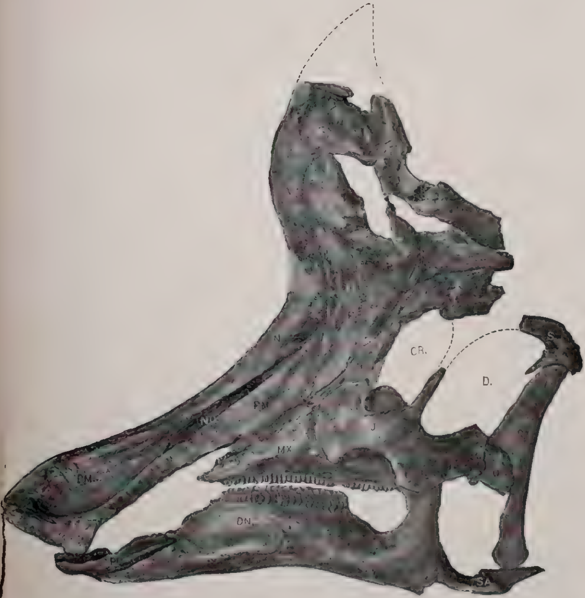
It was also suggested that the Government purchase abandoned woods and other cheap areas of land and marsh on which hunting could be prohibited, thereby forming breeding sanctuaries.

The officers of the London Biological Club are: President, Dr. H. W. Hill; Vice-President, Dr. S. Woolverton; Curator, Mr. J. F. Calvert; Secretary-Treasurer, Mr. J. W. Noble.

We extend to this new sister club our warmest greetings and best wishes for success in all branches of its work. The motto of the club, "Learn to live and live to learn," is an ideal one.

A. G.

P.M.
P.D.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THE WATERWAYS OF THE MACKENZIE RIVER BASIN*

By Charles Camsell.

Introduction.

The Mackenzie is one of the great rivers of the earth, with a drainage basin covering about one-fifth of the total area of Canada, exclusive of the islands of the Arctic. The subject, therefore, is too big a one to discuss in all its details within the limits of a short paper such as this, and I will make no attempt to do so. I wish, however, to draw particular attention to what I consider one of the most important features of the region, and one on which, to a very large extent, its future development depends, namely, its navigable waterways. The importance of these waterways, first in the exploration of the region and later in its settlement and the development of its natural resources, cannot be overestimated, and these waterways can and will be used far beyond the limited extent to which they are used at present.

I have selected the Mackenzie river region for two reasons. In the first place, I am familiar with much of its geography, its natural resources and its inhabitants, and I am able to speak of them with some degree of knowledge gathered throughout many years of residence in the region. For many years I wandered over much of the northern part of the region, from the barren lands on the east to the Pacific coast on the west, travelling in summer by canoe and in winter on snowshoes. During these years I travelled over nearly all the main routes, besides some that had not previously been explored.

In the second place, the Mackenzie river region is at present beginning to attract a good deal of attention among men who are anxious to develop its natural resources in minerals and agriculture. The agricultural portion, namely, that within the basin of the Peace and Athabasca rivers, has been widely advertised as "The Last West," and is being gradually settled up. This portion of the Mackenzie basin, together with that immediately to the north of it as far as the Liard river, contains the greatest area of unoccupied agricultural country in Canada, and it is the direction in which Canadian expansion in agricultural pursuits is bound to take place.

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*Paper read at the meeting of the Ottawa Field-Naturalists' Club on March 10th, 1914.

The northern and eastern portion, however, is still largely unexplored and, while it is never likely to support a large agricultural population, offers a vast field of possibly great value to the prospector and the mining man.

To develop the Mackenzie basin, railway companies are building lines into it from the south, one going north-westward from Edmonton into the Peace river, and another down the Athabasca river, and still others are asking for charters to cross it from Hudson bay to the Pacific. Its magnificent system of waterways, with thousands of miles of river and lake navigation, combined with the transportation that will be afforded by the proposed railway lines, will make the development of the more accessible parts a quick and easy matter.

Although it is more than 100 years since the first explorer descended the Mackenzie river to its mouth, yet at the present time practically all we know of most of the region north of Athabasca lake is confined to the valleys of the main streams and the shores of the Great Lakes, and that knowledge is very imperfect. The vast extent of country lying between the river courses is still virtually unknown, except to the Indians. What those portions of the country contain in the way of mineral resources it is impossible to say and unsafe to hazard a guess, in view of the surprises we have already received in opening up similar country in northern Ontario.

Twenty-five years ago the basin of the Mackenzie was the subject of an investigation by a select committee of the Senate of Canada. The report of that committee summarizes the information that was available at that time on its climate, inhabitants and natural resources. That information is valuable to-day, but little new information has since been obtained on a great part of the region. The time is at hand, therefore, when we should endeavour to learn more about this region.

PHYSICAL FEATURES.

The Mackenzie river is on the Arctic watershed, draining an area of 682,000 square miles, a territory covering about one-fifth of the total area of Canada.

The basin of the Mackenzie comprises three main physical features: On the west is the great series of parallel mountain ranges known as the Rocky Mountain system, into which many of the stronger tributaries of the Mackenzie cut deeply. On the east is the low-lying, rocky, broken Laurentian plateau, which in its northern part is treeless and is known as the Barren Lands. Between these two strongly marked features lies the broad lowland, through which the Mackenzie flows northward to the Arctic. The Mackenzie lowland is the northward extension of our own Great Plains region. It is a country of numerous lakes and of rivers flowing in shallow valleys, and its general level is only broken by occasional low ranges of hills. It corresponds to a certain extent with the region to the south, through which the Mississippi flows southward to the Gulf of Mexico. In contrast to the Mississippi region, however, the Mackenzie lowland is forested northward to its mouth and it embraces also within its limits some of the largest lakes on the continent.

The physical features of the Mackenzie basin then are these: A mountainous highland on the west, a low-lying, rugged, rocky and partly treeless plain on the east, and in the middle a broad, almost level, forested lowland, with the trunk stream, like a great artery, flowing northward to the Arctic sea, fed on the one hand from the melting snows of the mountains and on the other hand from the numberless lakes of the plateau region on the east.

The Mackenzie ranks as one of the eight large rivers of the earth. It is exceeded in length, drainage area and volume by the Mississippi, but has a greater length and drainage area than the St. Lawrence. Its length is reckoned at 2,550 miles to the head of the Peace river and its volume at about half a million cubic feet per second, or nearly ten times as great as the mean volume of the Ottawa river.

It is navigated by river steamers for 1,300 miles without a break, from its mouth up, and above that again on the Peace, Athabasca and other tributaries for a total length of about 1,400 miles in three sections. If we include its great lakes and those tributary streams that have already been explored, it has an estimated length of navigable river and lake shore line of nearly 7,000 miles in length.

HISTORY.

The history of the Mackenzie river district is intimately bound up with that of the fur trade, and particularly with that of the Hudson Bay Company. Organized in 1670, under the name of "The Honourable Company of Merchant Adventurers

Trading into Hudson Bay," a charter was obtained from Charles the Second, which carried with it not only the right to trade, but the ownership of most of the region now included in northern and western Canada.

For 100 years after its formation, "The Company" as it is familiarly known all over this vast territory, confined its operations to the immediate shores of Hudson bay. In 1770, however, they were induced to send an explorer, Samuel Hearne, into the country west of the Bay for the purpose of finding the locality from which the Esquimaux obtained the native copper which they made into arrow heads and other implements. Hearne's first two attempts to reach the locality failed, because, as his Indians told him, he had no women on the party. "Women," they said, "were useful to draw the toboggans and carry the loads, while the men hunted; and, besides that, they could easily subsist on the bones from which the men had eaten the meat." On his last journey, Hearne discovered Great Slave lake, and explored the Coppermine river to the Arctic coast. His journey is one of the most remarkable that has ever been made in the history of northern inland travel, and for a year and a half he travelled with a band of Chipewyan Indians, living as one of themselves, under the conditions of the greatest hardship.

About this time other fur trading companies, financed from Montreal and Boston, began to enter the field in opposition to the Hudson Bay Company. Competition, however, soon became so keen that they had to unite under the name of the North-West Company. Between this and the Hudson Bay Company the rivalry was so fierce that it often led to bloodshed, but it greatly stimulated explorations in the Mackenzie basin.

The North-West Company was the more aggressive of the two and pushed their outposts far into the interior. In 1778 we find them establishing a post near Athabasca lake, and in 1785 they reached Great Slave lake, fifteen years after Hearne.

It was from Athabasca lake that in 1789 Alexander Mackenzie, an employee of the North-West Company, started on his voyage of exploration northward. On this journey he crossed Great Slave lake, and descended the Mackenzie to its mouth, the first white man to make the trip. He was six weeks in descending the river, and during this time he met with many discouragements. Meeting a party of Indians at the mouth of Great Bear river, he was told that it would still take years to reach the mouth, and they would be all old men before they returned.

Three years later Mackenzie explored the Peace river, and crossed over to the Pacific, being the first white man to cross the continent north of Mexico.

In 1821 the two fur trading companies, finding that their profits were being reduced by competition, amalgamated under the name of the older company, and thus was ended one of the most interesting chapters in the history of the Northern Interior of Canada.

In 1819 Franklin made his first journey into the Mackenzie basin, when he explored the Coppermine river and a part of the Arctic coast to the east, a journey which cost him the lives of many of his party. In 1825 he made a second and more successful trip to the mouth of the Mackenzie and along the coast to the east and west.

Franklin's journeys mark the beginning of much Arctic exploration, and in the succeeding years the Mackenzie was traversed by such men as Dease, Simpson, Rae, Richardson and many others. Many of these explorers were sent out to search for traces of Franklin's last expedition, from which neither he nor any of his party ever returned.

Much of the details of geographical work in the Mackenzie basin was filled in by the officers of the Hudson Bay Company, but few of them considered it worth while to record their observations in writing or were trained for that kind of work. In more recent times, Father Petitot did a great deal of unobstrusive exploratory work, and later still we have such men as Macoun, McConnell, Ogilvie, Russell, Bell, Preble and many others. The most important geographical and geological work in this field in the present generation is that of McConnell, whose expeditions in 1887-88 and later, added more to our knowledge of the geology and natural resources of the region than any other expeditions since.

There is still much exploratory work to be done, and there are many blank spaces on the map of the Mackenzie basin to be filled in.

UNEXPLORED AREA.

In 1890, Dr. George Dawson, in a paper before the Ottawa Field-Naturalists' Club, made an estimate of the area of unexplored territory in Canada, exclusive of the islands of the Arctic. His results were obtained in this way. All lines along which reasonably satisfactory explorations had been made, he gave a width of 50 miles, that is to say, he assumed that the explorer learned something of the country 25 miles on either side of his route. The area between these lines was measured, and in this way he calculated that out of a total area of 3,729,665 square miles, there were about 1,000,000 square miles of unexplored territory in Canada. About 600,000 of this lay in western Canada, the rest being in what are now the provinces of Ontario and Quebec. No area less than 7,500 square miles was included.

Recently I had occasion to revise this estimate, but believing that the 50-mile strip was too wide, I took a strip 15 miles on either side of the explorers' route and reduced the explored lines to a width of 30 miles, which I think is quite enough. The result is that I find in western Canada there are areas aggregating 600,000 square miles in extent which must still be considered as unexplored. Of this area 240,000 square miles lie within the drainage basin of the Mackenzie river, an area which is almost equal to the area of the Province of Saskatchewan.

In commenting upon the area of unexplored territory that we have within the borders of the Dominion, Dawson remarked that it might be considered a reproach upon Canadians as indicating a lack of justifiable curiosity on what our country contains. That reproach still remains on us, and will continue so long as such a large proportion of our country remains unknown. Expeditions into the Arctic are useful in their way and add much to our knowledge of those little known regions, but it seems to me imperative that we should devote more of our attention to the more accessible parts of our unexplored region, on the chance of finding something on which to build productive industries and open fresh outlets for our national energy.

Every explorer, even at the present time, going into the north country, away from the regular lines of trail, takes a certain amount of risk, though that risk is not as great as it might appear to those who have no knowledge of that kind of work. Life, even for the natives, is a constant struggle, and the law of the survival of the fittest holds more rigidly in that region than in southern latitudes. It is not so much the severity of the climate and the intense cold of the winter season that take their toll of human life, but the uncertainty of the food supply. Game is very plentiful in certain parts and at certain seasons of the year, but the habits of some of the animals are migratory, especially the cariboo, on which such a large proportion of the inhabitants depend for food, and it is absolutely necessary to know those habits before one ventures without a sufficient food supply into regions distant from the few scattered trading posts.

A change in the course of the migration of the cariboo or the periodical failure of the rabbits has always been attended by starvation and hardship among the natives, and has, in the past, been the cause of occasional lapses towards cannibalism. If it were not for the food supply of fish, it would be exceedingly difficult for the natives to live at all, and it is safe to say that no country in the world has such a large quantity or excellent quality of food fishes as the lakes and streams of the Mackenzie basin.

INHABITANTS.

The population of the Mackenzie basin, at the present time, numbers only a few thousands, the larger proportion of which are Indians and half-breeds. Most of the white population is segregated on the southern fringe of the region. The widely separated posts in the central and northern parts of the basin average perhaps a dozen white people each, and these posts are usually about 150 miles apart. As far northward, however, as the Liard river and Great Slave lake, which might be considered the northern limit to which any considerable settlement of an agricultural population will take place, there is within the basin of the Mackenzie an area of about 200,000 square miles, which should be able to support a population of at least 2,000,000 people, or about ten persons to the square mile, and that mainly from agriculture.

WATERWAYS.

One of the most important features of the Mackenzie basin, and one on which to a very large extent the development of the region depends, is its system of waterways. These waterways are the main highways of the region, and except for the very southern fringe of the region, where railways and wagon roads are now being built, constitute the only routes of travel in winter as well as in summer. Until 25 or 30 years ago, the only craft plying on them were the York boats of the traders and the canoes of the natives. Since that time river steamers have been built and now run on all sections of the main waterway. At the present time steamers are running on the Athabasca, Peace, Slave and Mackenzie rivers.

The Mackenzie system of waterways, on which steamers can and do run, has a known length of river and lake shore line of 6,900 miles. This system is divided naturally into four sections, each section being separated from the adjoining one by natural obstructions of falls or heavy rapids which the steamers cannot surmount. These sections I have named for convenience:—(1) The Athabasca river section; (2) the Peace river section; (3) Athabasca lake section, and (4) the Lower Mackenzie section. The navigable river and lake shore line of these sections have been arranged in tabular form in the subjoined table. The figures are given in round numbers.

NAVIGABLE WATERS OF MACKENZIE BASIN.

Lower Mackenzie river section:		
Mackenzie river, below Great Slave lake	1,000	miles
Peel river, to mouth of Wind river	250	"
Bear river	90	"
Shore line, Great Bear lake	1,360	"
Liard river	440	"
Shore line, Great Slave lake	1,440	"
Slave river, Fort Smith to Great Slave lake	200	"
Total	4,780	"
Athabasca lake section:		
Slave river, Athabasca lake to Graham landing	100	miles
Peace river, Slave river to Vermilion falls	220	"
Shore line, Athabasca lake	560	"
Athabasca river, Athabasca lake to McMurray	170	"
Clearwater river	80	"
Total	1,130	"
Peace river section:		
Peace river, Hudson's Hope to Vermilion falls	550	miles
Athabasca river section:		
Athabasca river, Grand Rapids to McLeod river	325	miles
Lesser Slave river and lake	115	"
Total	440	"
Total for whole Mackenzie basin	6,900	"

The Athabasca river section has a length of navigable river and lake of about 440 miles, on which steamers drawing two feet of water may run. This includes the distance from the mouth of McLeod river to the Grand rapids on the Athabasca and Lesser Slave lake and river.

This section is separated from the Athabasca lake section by 90 miles of rapids on the Athabasca river, extending from Grand rapids to Fort McMurray, which is navigable with difficulty for scows and canoes. Navigation of this section of waterways will soon be done away with on the completion of the railways now being built to Fort McMurray and Peace River Crossing.

The Peace river section is 550 miles in length and extends from Hudson's Hope down to Vermilion falls, and is navigable for steamers with a 2½ foot draft. The Loon river, a tributary of the Peace, in this section is said by McConnell to be navigable for powerful river steamers for a distance of 150 miles, but is not included in the table.

This section is interrupted at its upper end by the Peace river canyon, where the river breaks through the Rocky Mountains, and is separated from the Athabasca lake section by the rapids known as Vermilion falls, where there is a fall in the river of about 25 feet. This obstruction could possibly be improved to such an extent as to allow steamers to pass from the Peace river section into the Athabasca lake section. The Peace river section will shortly be connected by railway with Edmonton on the completion of a line from that point to Peace River Crossing.

The Athabasca lake section has a length of navigable river of 570 miles for boats of 2½ foot draft, and a shore line on Athabasca lake of about 560 miles in length, making a total of 1,130 miles. This section includes the Athabasca river from Fort McMurray to Athabasca lake, 170 miles in length, 80 miles of the Clearwater river, the Slave river from Athabasca lake to Graham's landing, 100 miles, and the Peace river from its mouth up to Vermilion falls 220 miles. It is separated from the Lower Mackenzie section by a series of rapids on Slave river about 16 miles in length, where there is a total fall estimated at 250 feet. This break in navigation is now overcome by a wagon road of 16 miles from Graham's landing to Fort Smith, but scows and light craft are usually taken down through the rapids by making four short portages. On the completion of the Alberta and Great Waterways Railway from Edmonton to Fort McMurray, the Athabasca lake section will be directly connected with the main system of Canadian railways and there will not be the necessity for traversing the 90 miles of rapid, broken river which now separates it from the end of the railway at Athabasca Landing. Steamers are now running on this section throughout the summer season, which usually lasts about five months.

The Lower Mackenzie section is by far the most important of the whole system, covering as it does about 4,780 miles of known river and lake shore line, on which a depth of water, ranging from two feet to six feet, may be found. This section embraces the trunk stream from Fort Smith down to the Arctic coast, a distance of 1,300 miles, over which a depth of five feet of water can be obtained. This, with the shore line of Great Slave lake, 1,440 miles in length, and the small part of Peel river, is the only part of the section that is now being used by steamers. The remainder of the navigable waters of the section are only available for light draft steamers and cannot be navigated by the deeper draft steamers that now ply on the portion previously mentioned. The Liard river is obstructed on its lower part by a strong rapid which, however, could be ascended by powerful light draft steamers with the aid of a line, making the navigable water on this stream 440 miles in length. Great Bear river, 90 miles in length, also has a shallow rapid about half way up its course which could be ascended in the same way. With this obstruction removed or overcome, the whole of Great Bear lake, with a shore line of about 1,360 miles, becomes connected with the Mackenzie system. Peel river is navigable for shallow draft steamers from the Mackenzie to the mouth of Wind river.

The Mackenzie has a number of other tributaries about which little or nothing is known, but which, on exploration, might prove to be navigable for certain distances. Among these are Little Buffalo river, Willow river, Hareskin river, Arctic Red river and some others.

The Lower Mackenzie section is navigated at present by a few small steamers that are operated solely for the benefit of the fur traders and the missions. In spite of its greater length and the depth of its channel, it is, however, used less than any of the other three sections. This, because of its remoteness.

Taking the Lower Mackenzie section and the Athabasca lake section together, it will readily be understood how important they become in connection with the exploration and development of the whole Lower Mackenzie region and a great part of the region to the east, which cannot easily be reached from Hudson bay. These two sections of the waterways are to-day suffering from the handicap of being separated from railway connection by obstructions which are not easily surmounted. This handicap will, however, be removed when the promised railway to Fort McMurray is built. It would greatly increase the value of these waterways if the obstruction of 16 miles at Fort Smith could be overcome, either by a tramway or a system of locks, and it is probable that one or the other of these projects will one day be carried out.

It is difficult to over-estimate the value of the waterways of the Mackenzie basin, not only to the region itself but to Canada as a whole. They constitute an asset of the first importance in the development of the natural resources of the region. Not only have they been the channels of trade and exploration in the past, but they will continue to be in the future the means by which further exploration, settlement and development will be carried out. In the early history of the region the waterways formed the routes by which the explorers traversed the country, and while, at the present time, most of the main streams have been explored, yet there are vast areas between these main streams, aggregating 240,000 square miles in extent, that are still unknown and the smaller streams and watercourses constitute the easiest and only natural means by which these areas are to be explored. To-day, with hardly any exceptions, the settlements of the region are situated on the waterways, and for a long time to come these waterways will determine the location of the centres of population in the region. No doubt, in the future, mining camps may be opened up in the interstream areas and agricultural communities formed in sections where the land is suitable, as is now being done in the south-western portion of the region, but in the early stages of development and growth of either of these two classes of communities, the watercourses must be used before other routes of travel are opened up.

Railways will eventually be built into the region from the south, and this period is now beginning for the extreme southern fringe of the Mackenzie basin, but unless there is some extraordinary mineral development in the northern part of the basin, the limit northward, to which the future railways will extend, will be determined by the limit at which successful farming operations can be carried on, for, except in certain exceptional cases, the products of agriculture furnish the bulk of the traffic for the railway lines.

Until these railways are built, however, water transportation must be practically the only means by which the traffic of the region is handled, and, indeed, the building of railway lines will by no means do away with the navigation of the lakes and rivers, when there is such a magnificent system of waterways, because of the difference in the cost of the one method of transportation over the other.

Of course, on account of the climate, it is not possible to navigate the lakes and rivers of the region for a longer period than four to five months of the year. On the other hand, however, the winter routes, at the present time, all follow the river courses, either horses or dogs being used, in different parts. The winter mail that is sent down the Mackenzie valley by the Government to the various posts eventually reaches Herschel island, in the Arctic ocean, and for the whole of the distance from the end of the railway line at Athabasca landing—a distance of about 2,000 miles—the route is over the ice of the Athabasca, Slave and Mackenzie rivers, and the conveyance in toboggans drawn by dog teams.

Again the waterways are of importance, because the natural resources that are known to exist on them, and those which will in the natural course of events be developed first, are to be found along them. The best agricultural land, and that which will be first utilized, is situated along the banks of the streams where the drainage is good. There is undoubtedly much that lies back from the stream courses, but this will not be taken up and worked until the available area along the valleys is occupied. The best timber also is situated on the banks of the streams.

Not only are the waterways of the Mackenzie basin important from the point of view of navigation and transportation, but because of the quantity and variety of food fishes which they contain.

The fisheries of the Great Lakes of the Mackenzie basin—namely, those of Athabasca, Great Slave and Great Bear lakes—are among the most valuable of the assets of the region. Hundreds of thousands of excellent whitefish are caught in Athabasca and Great Slave lakes every year. A great many more were caught annually a few years ago, when the trading posts were more dependent on the native food supply than they are now, and McConnell's estimate of half a million pounds of whitefish being taken from Great Slave lake in the autumn fishery of 1887 is not too large. The fisheries of Athabasca lake are equally good in proportion to its size, but both of these lakes are outdone by Great Bear lake in the size, quality and variety of its fish. Whitefish there go up to 12 pounds in weight and trout to 50 pounds or more, besides which there is the herring, which is not found in either of the other lakes. Even at present, whitefish form a very important item in the diet of the natives, and it has been proved by long years of experience that a man can live and thrive on a diet of whitefish, and whitefish alone. He will tire of any other kind of fish, even of trout, but the whitefish never In fact, the taste for whitefish increases with the use of it.

Other natural resources which will be developed by means of the water routes are the minerals, among which are oil and gas, coal, iron ore, salt, gypsum, and gold, silver and copper ores. The best known of these, and possibly one of the most important, is the oil, which is known to occur as seepages at points from one end of the region to the other. With the exception of placer gold from the Omenica and Cassiar districts, however, no production has yet been made of any of these minerals.

Furs are the chief products of the region at present exported, and the Mackenzie river region is considered by the Hudson Bay Company to be the best fur-producing portion of Canada.

LICHENS FROM VANCOUVER ISLAND.

By G. K. MERRILL.

The lichens here commented upon were collected by Prof. John Macoun in the vicinity of Sidney, Vancouver Island. With two exceptions, the plants are new to the Canadian flora, and several are recorded as hitherto unreported from the North American Continent. Other interesting discoveries of Prof. Macoun await future comment.

CLADONIA FURCATA var. CONSPERSA Wain. Mon. Clad. I., p. 335 (1887).

Thin earth over rocks, Beaver Lake and Fowl Bay.

Podetia erect, colored above is in the var. *palamaea*, below glaucescent, above more or less densely squamulose and isidio-squamaceous, cortex continuous below but above rimose-diffract. Unreported previously from America.

USNEA CAVERNOSA Tuck. in Agass, L. Superior. Appendix (1850).

Branches of trees, Sidney.

Remarkable because of the main branches showing articulations in the manner of *U. articulata*, and from the fact that the cortex here and there is papillose or papillose-scabrous.

LECANORA (ASPICILIA) GIBBOSA var. ZONATA Wain. Medd. Soc. pro F. at Fl. Fenn. t. VI (1881), p. 168.

Rocks, Sidney.

This is a remarkable condition of the species characterized by a sub-effigurate thallus, which is zonate toward the circumference.

New to America.

LECANORA (ASPICILIA) GLAUCOMELA Tuck. Gen., p. 118 (1872).

Alder trunks, Beaver Lake.

Spores rounded, short-ellipsoid or ovoid, serially disposed in cylindrical asci, hymenium and hypothecium without color, the paraphyses distinct and lax.

The thallus varies from greenish-ashy in the specimens from Prof. Macoun to sordid-greenish-brown in examples from Washington collected by Mr. A. S. Foster. Tuckerman was inclined to make the present a sub-species of *L. oculata*, an assumed relationship that no one but an arrant Sporologist may assent to.

BIATORA ATROFUSCA Flot. in Hepp. Exs. p. 268 (1857).

Bark of maples and Douglas fir, Sidney.

Spores oblong-ellipsoid 15–19 x 7–8 μ, hypothecium brown, paraphyses distinct but coherent, tips thickened and brown, hymenial gelatin with I + intense-blue.

Thallus less developed than in the muscicoline conditions collected in Maine, where it was found over rocks and about the base of trees. Without question, Tuckerman united the present with *B. sauguineoatra*, and the distribution cited for that species must, in some part, represent the plant of this note.

Biatora (Biatorina) lenticularis (Ach.) comb. nov. forma nigricans Arn. in Flora 1860, p. 14.

Rocks, Sidney.

Spores ellipsoid or variously difform, bilocular, the epispore distinct, 10–12 x 5–5.5 μ, hymenium and hypothecium hyaline, paraphyses distinct, more or less discrete, tips enlarged and black, asci inflated-clavate or oblong, hymenial gel. with I + sordid-blue.

Previously unrecorded from America.

LECIDEA LATYPEA Ach. Method. Suppl., p. 10 (1803).

Fragmental rocks, Sidney.

Spores ellipsoid 15–18 x 8 μ, hymenium colorless, hypothecium brown, paraphyses distinct, slightly discrete, tips blue-green, asci ventricose, hymenial gel. with I + intense-blue.

Thalline reaction K +, C + orange-red.

While resembling forms of *L. parasema* externally, the internal characters preserve specific distinctness.

Macoun's Canadian list cites the plant from Newfoundland, and it has since been collected in Alaska, California and Washington.

LECIDEA LATYPIZA Nyl. Obs. Pyr. Orient, Bull. Soc. Linne. de Norm. 2 serie VII, p. 201 (1872).

Rocks, Sidney.

Differing from *L. latypea* only in the absence of reaction with Ca Cl.

It has also been collected in California and Washington.

LECIDEA CONFLUENS forma OXYDATA Leight. Lich. Fl. G. Brit. Ed. III, p. 304 (1879).

Schistose rocks, Sidney.

Spores ellipsoid, 16–18 x 8–9 μ, hymenium hyaline, hypothecium dark-brown, paraphyses distinct, compacted, tips brown, hymenial gel, with I + deep-blue.

Hypothallus little visible in our specimens.

Unreported from America previously.

LECIDEA (RHIZOCARPON) DISTINCTA Stiz. in Lich. Hyperb., p. 47

Rocks by the roadside, Sidney.

Spores colorless, 4-loc. halonate 25–29 x 10–12 μ, eight, or fewer, in the ascus, hypothecium and tips of the paraphyses purplish-brown, hymenial gel, with I + blue or here and there violet.

This is one of the multifarious exhibits of the section *Rhizocarpon* of *Lecidea*. In thalline characters it is similar to many other species of the section and depends for its specific standing wholly upon the hymenial characters. Unreported previously from America.

XYLOGRAPHA HIANS Tuck. Syn. II, p. 113 (1888).

Dead wood, Sidney.

Hymenial gelatine with I + faint blue.

Also detected in material sent by Mr. A. S. Foster from Washington.

OPEGRAPHA BETULINA Sm. Engl. Bot. t. 2281 (1811).

Young trees, Sidney.

Spores 2–4 locular, typically 4, halonate, 22–28 x 8–10 μ, hypothecium brownish, paraphyses distinct, slender, not coherent, tips brown, asci oblong or inflated-clavate, hymenial gelatine with I + wine-red.

Under the synonym of *O. atrorimalis* Nyl., reported from California, but little is known of the species in America.

OPEGRAPHA VARIA forma DIAPHORA (Ach.) Nyl. Scand., p. 253 (1861).

Various rough barks, Sidney.

Occurs in Washington on both smooth and rough barks.

Arthonia (Arthothelium) Macounii sp. nov.

Thallus hypophloedes albus vel cinereo-albidus effusus; apothecia .10–.05mm. lata orbicularia et elliptica vel angulosa plana vel leviter emersa nigra; sporae hyalinae cylindrico-abovoideae 40–47 x 13–14 μ muriformi-multiloculares, loculus superior reliquis multo major; hypothecium hyalinum, asci saccato-abovoidei 8 spori; gelatina hymen. iodo vinose-rubens.

Est valde affinis *A. ampliatae* Kn. et Mitt.

Ad corticem Abietum juniorum. Sidney.

Young spores 4–loc., cells of those mature commonly once divided, but sometimes twice, the large cell at times irregularly septate. Proportion of the large cell to remainder of the spore 3-10 of its length.

VERRUCARIA AETHIOBOLA var. ACROTELLA (Ach.) A. L. Sm., Brit. Lich. II, p. 282 (1911).

Rocks, Sidney.

Thallus a filmy dark stain, spores 22 x 9 μ, agreeing well with the measurements given by Nylander. The relatively feeble development of the variation prevents its easy recognition.

Unrecorded from America.

LIST OF PLANTS IN FLOWER IN THE VICINITY OF SIDNEY, VANCOUVER ISLAND, MARCH, 1914.*

By JOHN MACOUN, M.A., F.R.S.C.

The following is, I believe, the first list of Vancouver Island spring flowers that has been published, and as most of the genera and some of the species are also found in eastern Canada, it may prove of interest to readers of THE OTTAWA NATURALIST. Fifty-seven species of phanerogams were noted in bloom during the month. It may be said that a visit to Victoria during the last week in March would probably have added ten or more species to the list.

March 1—Alnus oregana, Nutt.
" 2—Stellaria media, (L.) Cyrill.
Brassica campestris, L.
Taraxacum officinale, Weber.

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*Published by permission of the Director of the Geological Survey.

March 4—Claytonia spathulata, Dougl.
" sibirica, L.
Salix Scouleriana, Barratt.
" " var.
Senecio vulgaris, L.
Ulex Europaeus, L.
" 6—Shepherdia canadensis, (L.) Nutt.
Paspalum?
Spergula sativa, Boenn.
Lysichiton kamtschatcensis, Schott.
" 13—Sisyrinchium grandiflorum, Dougl.
Saxifraga integrifolia, Hook.
Mimulus alsinoides, Benth.
Collinsia parviflora, Dougl.
Erodium cicutarium, (L.) L'Her.
Draba verna, L.
Barbarea vulgaris, R. Br.
Brassica arvensis, (L.) BSP.
Ranunculus occidentalis, Nutt.
Pachystima Myrsinites, Raf.
" 16—Erythronium giganteum, Lindl.
" 17—Stellaria nitens, Nutt.
" 18 Berberis Aquifolium, Pursh.
" nervosa, Pursh.
" 21—Dodecatheon latifolium, (Hook.) Piper.
Lithophragma parviflora, (Hook.) Nutt.
Sanicula Menziesii, Hook. and Arn.
Arbutus Menziesii, Pursh.
Arctostaphylos Uva-Ursi, (L.) Spreng.
Arenaria macrophylla, Hook.
Fritillaria lanceolata, Pursh.
Collinsia grandiflora, Dougl. var. pusilla, Gray.
Aira praecox, L.
" 23—Fragaria cuneifolia, Nutt.
Acer macrophyllum, Pursh.
Pseudotsuga mucronata, (Raf.) Sudw.
" 24—Ribes Lobbii, Gray.
" 25—Cardamine oligosperma, Nutt.
Dentaria tenella, Pursh.
Cerastium viscosum, L.
" 26—Equisetum arvense, L.
" 27—Petasites speciosa, (Nutt.) Piper.
Rubus spectabilis, Pursh.
Ribes divaricatum, Dougl.
Cytisus scoparius, (L.) Link.

March 28—Populus trichocarpa, T. and G.
" 30—Nemophila pustulata, Eastw.
Fragaria bracteosa, Heller.
" 31—Claytonia perfoliata, Don., var. depressa, Gray.
Acer Douglasii, Hook.
Rubus macropetalus, Dougl.
Populus vancouverensis, Trel.
Equisetum Telmateia, Ehrh.

BOOK REVIEWS.

CHECK LIST OF THE FISHES OF THE DOMINION OF CANADA AND NEWFOUNDLAND.—By Andrew Halkett, Naturalist, Dept. Marine and Fisheries. C. H. Parmalee, King's Printer, Ottawa, 1913.

A sumptuous quarto volume in grey art cloth and gold, bearing the above title, has been issued from the Fisheries, Museum, O'Connor Street, under the Marine Department. It consists of 138 pages of text, introduction, and indexes, with fourteen heliotype plates of a costly character. The author, it will be recalled, is a former President of the Ottawa Field-Naturalists' Club, and is engaged in the Fisheries' Museum, and, as stated in the introduction, his object has been to supply a complete list of the fishes of Canada. Such lists as that of the Fresh-Water Fishes of Canada, printed in Montreal in 1864 for the author, Mr. H. Beaumont Small, a former active member of the Ottawa Club, and the excellent little volume by Mr. C. W. Nash, a check list of the fishes of Ontario, issued in 1908, are the only existing lists, apart from some New Brunswick, British Columbia and Manitoba lists, which cover the fresh-water species, while the lists of Kendall, Eigenmann, and, above all, of Jordan and Evermann, include marine fishes, but do not profess to treat specially of Canadian species, excepting Kendall's Labrador list. Mr. Halkett has drawn upon these authorities freely, and as the printer has excelled himself, the paper is thick plate paper with wide margins, and as the plates are costly heliotype reproductions, the result is a very striking publication. The value of such a check list, however. is not in plates or costly paper, but in completeness of matter, handy form and size, and compact description and arrangement. In these respects the work will be disappointing to some, and the figures, 181 in number, are in very many cases from defective coloured casts, not from the actual specimens, and details, such as the plates in the gill-cover, and especially the fin-rays, are without exception, absent or blurred. The value of this check list would have been very substantial had each species been represented by an actual drawing instead of a very indistinct protographic effigy. The State of New York, some years ago, issued some plates, in annual reports, with details most perfectly delineated, and the colours accurately reproduced. Such drawings a large number of working naturalists have found most useful, and plates of that valuable character are far less expensive than costly heliotypes, such as the present volume contains. It is to be regretted that some figures show nothing at all. Thus, figures 151 and 152 Plate XIII, resemble figures of policemen's batons, but really are photographs of the Californian hag-fish. If the two figures of the pickerel or pike-perch in Mr. Nash's Check List be compared with the four very indistinct figures 112 and 113 (*Stizostedion vitreum*) and figures 114 and 115 (*Stizostedion canadense*), the contrast will be appreciated, and the lack of scientific value in the latter realized. Very few of the figures in these costly plates are of any scientific or practical utility. The compiler is not to blame for this. Photography in such cases is the worst method to adopt. As to the work itself there is evidence of painstaking industry, and, on the whole, much accuracy. Occasionally a slip occurs, as, for example, the note on page 55, which suggests that the fish called grayling in southern Alberta is *Thymallus tricolor montanus*. It is nothing of the kind, but is the active, gamey little whitefish, *Coregonus williamsoni*, as the Commissioners of the Alberta Fishery Commission (Marine Department, Ottawa, 1912, page 19,) distinctly stated. The value of the work would have been greatly increased had the author followed the plan of the Rhode Island Commission's Check Lists and given some details, wherever possible, of the spawning period and the nature of the eggs. Much information has been recently accumulated in regard to that important phase of fish life, and it is stated that a forthcoming Check List, to be issued by the Biological Board, will include such valuable scientific information. Mr. Halkett must, however, be congratulated on completing a very handsome volume, involving much thankless drudgery and consultation of authorities, and the book fills a vacant place, much needing to be filled.

C.

FODDER AND PASTURE PLANTS. By Geo. H. Clark, *B.S.A.*, and M. Oscar Malte, *Ph.D.*, with water colour illustrations by Norman Criddle. Available at the office of the Superintendent of Stationery, Government Printing Bureau, Ottawa; price 50 cents.

This admirable work is a valuable contribution to our knowledge of fodder and pasture plants in Canada. It has been several years in preparation and may be described as a companion volume to "Farm Weeds in Canada," a work which, upon its appearance several years ago, called forth very favourable comment because of the excellence of the matter and the effective method of its presentation.

In "Fodder and Pasture Plants," the authors have succeeded exceptionally well in treating a technical subject in language intelligible to the general reader. Without sacrificing scientific accuracy, they have presented, in a popular way, the essentials in the successful production of fodder and forage crops adapted to general growing in Canada. The information relative to these crops has been presented in concise, yet sufficiently comprehensive, form. The practices advocated by the authors have behind them the sanction of accepted good farm practice. supplemented by the results of recent experimental research.

In addition to containing forty coloured drawings of the seeds of grasses and legumes of greatest economic importance in Canada, the volume contains twenty-five full-page illustrations, in natural colours, of the principal crops under consideration. These artistic reproductions are from the work of Mr. Norman Criddle and contribute much to the attractiveness and value of the text. With the exception of the root systems represented, the illustrations are remarkably true to life.

The quotations from early agricultural writers are, in the main, apt. In a work of this character, the wisdom of quoting so freely from such sources leaves room for difference of opinion. Since, however, the arrangement of the plates determined the paging of the text, this departure is perhaps justifiable.

This publication has been issued under the direction of the Hon. Martin Burrell, Minister of Agriculture for the Dominion. Copies may be had from the Superintendent of Stationery for the nominal sum of fifty cents. Farmers, students and teachers alike will find in this excellent work much valuable information relating to fodder and forage crops the value of which, in the economy of general farming, agriculturists have been slow to appreciate.

L. S. KLINCK.

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ABSCISSION.[1]

By Francis E. Lloyd.

Among the ever recurring phenomena which characterize the lives of plants, perhaps none is more impressive than the usually sudden and complete loss of foliage by trees and shrubs on the approach of winter, unless it be the untimely occurrence of the same change ensuing upon an untoward drought or some equally unfavourable climatic disturbance. The uncouthness and semblance of death attaching to a leafless tree when it should be enfolded in a robe of verdure strikes a sad note, however little one may appreciate the exact nature of the importance of leaves in the economy of the plant. And, when one enters a tropical region, it is the everlasting verdure which at once wakens the interest.

But the fall of the leaf is only one of a series of similar behaviours, in many instances leading to an increase in individuals rather than a mere riddance of parts which are unable longer to resist the conditions imposed upon them. The multiplication of simple plants, such as the algae, by a separation between contingent cells, the breaking away of pieces of stem, of leaves, brood-bodies and the like, so commonly occurring, but usually unobserved, in the mosses (Correns, 1); the shedding of leaves in plants which, like *Bryophyllum* and *Begonia*, use them as a means to propagation by the growth of new plantlets from the leaf-margins or elsewhere; the separation of staminate flowers in the hydrocharids in order to effective pollination—these exemplify the same activity leading to renewed life rather than to the mere sloughing of parts moribund or dead.

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[1] The text of a lecture delivered under the little "Abscission in Flowers, Fruits and Leaves" before the Ottawa Field-Naturalists' Club, Jan. 27, 1914. Although of a general nature, it includes the results of original observations on a series of about 30 species, with especial reference to the mechanism of abscission. The details of this phase of the work are reserved for another paper, and a brief preliminary account only is given here. All the work on the cotton, (*Gossypium herbaceum*), here reported was done at the Alabama Polytechnic Institute (account of Adams Fund) or at West Raleigh, N.C., (accounts of Bureau of Plant Industry, U.S. Dept. of Agric. and of McGill University).

The processes by which these results are brought about and the conditions leading to them constitute the subject of this essay. There is also the purpose of presenting a general summary of the problem of abscission as at present understood. It will be deemed unnecessary to make an extended historical review of the development of our knowledge, which, from lack of space, must in any event be excluded.[2] Only pertinent references, therefore, will be made during the progress of this discussion. Unless specific mention is made, it will be understood that the more highly organized plants are meant.

THE PARTS OF PLANTS WHICH MAY BE SHED.

Aside from the outer layers of the stem, namely, the epidermis and dead cortex, with included tissues, the parts of the plant which may be shed by the process of abscission are transverse segments of the stem, including one or more internodes, either with or without attached flowers; or any lateral organs, either foliar or floral.

Beginning with leaves as the most familiar examples, we notice further that either the leaf as a whole falls away from the supporting stem, or, when compound, the individual leaflets fall separately (Ash, Horse Chestnut, Boston Ivy, etc.). The instances of *Ampelopsis Veitchii* and *Citrus* sp. may be especially mentioned since in these forms the apparently simple leaves are separated both at the base of the leafblade and at the base of the petiole. *Ampelopsis Veitchii*, however, produces trifoliolate leaves on older shoots, and certain *Citrus* sp. have also compound leaves, so that the single blade may be regarded as a terminal leaflet or as a fusion product of three. In the cases which I have studied (*Ampelopsis*, *Vitis*, *Fraxinus*, *Aesculus*, *Negundo*) leaves and leaflets present no difference in the method of separation, in concurrence with earlier students (Tison, Loewi, (3) in *Citrus*), so far as attention has been paid to the matter.

The position of the plane of separation varies, but is to be found near the base of the organs in question. In the case of the petiole, it may occur at a point further removed from the stem, and thus leave the leafbase clasping more or less completely the axillary bud (*Smilax*, *Philadelphus*, *Platanus*). In *Smilax*, the leaf is cut off above the tendrils, so that, although these are of foliar origin, they are allowed to remain supporting

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[2] This material may be in large part found in the detailed paper of Tison (2).

the plant. Aside from special cases of this kind, there is some variation of position, as noted by Loewi (3, page 998) in the leaf of *Cinnamomum*, in which the abscission plane was found, in a very few instances, to lie in the neighbourhood of 2 mm. above the expected position. In *Hamamelis* there are two parallel separation zones a short distance apart. The leaf is first set free by the upper one in the autumn, and in the early spring following a short segment is thrown off (Tison 2). Practical identity of position is attained only in those forms possessing a differentiated layer of tissue, such as that in *Polygonum*, *Syringa* and *Zizania*, in which it happens that the abscission plane lies, but why it should do so is not clear. On the other hand we can very surely say that in many, if not in most instances, there is no slightest suggestion in the histological structure of the organ of a specialized abscission layer (*e.g.*, *Vitis*, *Spiraea*, *Philadelphus*, *Hydrangea*), and we may say, with Loewi, that abscission is a physiological response, adaptive if you please, to stimuli, and is not conditioned by a predetermined structure.

The falling away of the leaf, far from being an economical process, is a necessary response to conditions imposed. To be sure, acids of silica and lime usually assumed to be useless, occur in double the usual quantity in falling leaves, while there is a decrease, due to movement into the stem, of nitrogen salts. The conclusions of Ramann, (4) do not, however, accord wholly with those of Combes (1911), who has held that a migration of substances prior to leaf-fall does not occur, nor are those remaining in the fallen leaf to be considered *a priori* as non-utilizable. Much, he maintains, remains which might have been used. The leaf may in this respect be compared to dead and exfoliated bark, which also is not devoid of useful materials. Foods (starch, sugar) are certainly lost in floral parts and in fruits which have suffered abscission—*e.g.*, starch is lost with the corolla of *Gossypium*.

The abscission of cotyledons normally occurs in the aroid *Cryptocoryne ciliata* and in the mangrove (*Rhizophora*) (Goebel, 6). These plants are viviparous; their embryos withdraw the overplus of foods from the cotyledons, which, after abscission, remain within the fruit. The seedling then shifts for itself, finding anchorage in the soft mud of the shore line habitat. There are, however, other viviparous seedlings which are released from the parent plant without separation of the cotyledons (*Podocarpus*, Lloyd, 7).

Such adaptive behaviour may be matched by examples of disharmony. The "calamander," a sort of teak (*Diospyros ihrsuta* L.), of Ceylon, is one such. Abscission of the cotyledons intervenes so constantly during the earlier stages of seedling development as to make it very difficult, if not impossible, to grow the tree from the seed.[3] The usefulness of the seed is thus defeated.

Again, many plants are unable to shed their leaves at all. *Eupatorium adenophorum*, like a multitude of others, does not do so in nature, nor, as found by Wiesner (1905, through Loewi), even under experimental conditions. This disharmony is not confined to herbaceous plants, as I have found it to occur in the perennial shrub *Parthenium argentatum*. This plant, neither in its native health nor under a variety of experimental conditions, is found to lose its leaves save by a long delayed method of wear and tear, somewhat hastened it may be by a clumsy development of corky tissue continuous with that of the stem, but developing first from a centre at the leafbase. (Lloyd, 8).

ABSCISSION OF SHOOTS.

Not a few trees are able to shed, by a process similar, if not identical,[4] with that in leaves, their smaller, and in some cases, even their larger branches. The Central American Rubber Tree (*Castilloa elastica*) is a striking illustration, and has been described by O. F. Cook (9). The young tree produces no permanent branches till the third or fourth year. Those which develop before that time are long and semi-pendulous, measuring scarcely one inch in diameter at the base and reaching a length of ten or twelve feet. These are all shed, being released by a softer layer of tissue, arranged in the form of a socket, quite at their basal extremities. The loss of twigs by poplars, willows and other trees is comparable with, if not as striking as, that of *Castilloa*. The shedding of twigs produced from axillary buds which grow at once, instead of entering a resting condition, occurs in the camphor tree (in Alabama), which, in respect of general appearance of the abscission, is very similar to *Castilloa*. The mechanism of abscission in its living tissues (cortex) is identical with that of the leaf, as v. Hoehnel observed in *Populus*, *Salix*, beech, etc., and as Loewi also found to be the case in *Cinnamomum Camphora*. *Euonymus atropurpureus*, which is grown in this part of the world as a small ornamental tree, also sheds its twigs, more especially those which happen to be exposed to the denser shade of overhanging branches. Loewi observed this behaviour in potted plants, attributing it to too high a relative humidity, though it occurred also in cut branches, but more slowly, when exposed to drier room air.

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[3] My attention was drawn to this instance by my colleague, Professor Willey. See Wright, H., Ann. Roy. Bot. Gard. Peradeniya, vol. 2 (?).

[4] It is obvious that when large masses of wood, etc., are involved, some sort of fragmentation must take place, but a really satisfactory account of the underlying causes is not yet available. See, however, v. Hoehnel, 10, 11.

The abscission of internodes and of shoot-tendrils (such as those of *Vitis*, *Ampelopsis*) offers another case in point. The tendrils may either persist and serve as a permanent mechanical support for the plant, or they may be shed from the more distal portions of the new stems, as occurs at the end of the growing season. The behaviour may be very well observed in *Ampelopsis Veitchii.* The internodes of the apparently chief shoots are equally marked in this respect. In both ordinary shoots and in tendrils, the plane of abscission lies near, but not precisely at, the base of the internode affected, and is not marked by any histological differentiation. In certain instances the abscission-plane is oblique, or even decurrent, such deviations being found where morphological displacement has occurred. According to the more generally accepted view, the tendril in *Ampelopsis* and *Vitis* is a chief shoot. Its normal position is therefor directly opposite a leaf, from the axil of which the supplanting shoot of the second order arises. However, the tendril frequently, and even usually may, in particular individuals (*Ampelopsis quinquifolia*, according to my observation), suffer an upward displacement of as much as 20 mm., and in such event the abscission plane of the internode above the secondary shoot will be oblique in a degree commensurate with the amount of displacement of the tendril. (Figure 1.) The fact of this morphological disturbance is of great importance in understanding the position of the abscission-plane in the cotton peduncle, as we shall presently see.

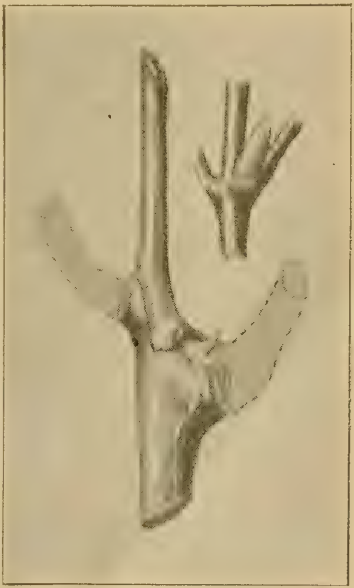

Figure 1. Oblique abscission of an internode in consequence of the upward displacement of the tendril which normally occurs directly opposite a leaf. The normal relation is shown in the upper figure. (*Parthenium argentatum.*)

The only other further example of shoot abscission to be here cited is that of the clumps of spines in certain cacti, of which *Cereus Thurberi* serves as an excellent example. The fleshy fruits of this species are covered by an armour of spines arranged in clusters, and, as the fruit matures, they are sloughed off. The mechanism involved has not, to my knowledge, been studied. It would be useless to speculate on the "biological significance" of this procedure.

THE ABSCISSION OF FLOWERS AND FRUITS.

The structure aggregates which, specialized with reference to reproduction, take the form of flower-shoots, and, with the progress of events, of fruit shoots, simple (supporting a single flower) or compound, may or may not normally be shed.[5] The cotton, peach and tomato, under, at present, little understood conditions, sometimes lose a very large proportion of their flowers before anthesis, to the great prejudice, as it is assumed, often not out of harmony with the facts, of the expected crop. Farmers and horticulturists frequently lose 50 per cent. or more of the theoretical returns for the labour expended.

Abnormal shedding of the entire and perfect flower *while open* is, for reasons not comprehended, relatively rare, though it is known to occur in cotton, as I have myself observed. *Mirabilis jalapa*, the well known Four-o-clock, does so phenomenally under untoward conditions, and has been studied particularly by Hannig (12), who furnishes in his paper a list of some twenty or thirty other species which may behave similarly. On the other hand, normal abscission intervenes, to remove staminate flowers after pollination has occurred, in the cucurbits, and before, and as a *conditio sine qua non* to it, in the hydrocharids. The eel-grass is a classic example, whose staminate flowers are loosened in the morning (Wylie, 13) and, floating on the surface of the water, open and bring their pollen by the chance of currents and surface tension into contact with the stigmas of the pistillate flowers. A still more remarkable behaviour is that of the closely related *Enalus acoroides*, of the eastern tropical shores. This has been more fully studied by Nils Svedelius (14), who points out, however, that Zollinger was the first to record the floating of the staminate flowers. These, according to Svedelius, are released at low tide. Having come into contact with the pistillate flowers, which reach to the surface only at this time, they are grasped by the petals, and in spite of the rise of the tide, are held firmly, and pollination proceeds below the water surface.

Just as abscission occurs before and during anthesis, conditions may be such as to induce the shedding of the developing fruit. The "boll-shedding" of the cotton intervenes chiefly during the earlier stages of development of the fruit or "boll," as it is acceptedly called, as shown by figures derived from a study of Egyptian cotton by Balls (15) and of the Alabama upland plant by myself. Balls found that upwards of 90 per cent. of the bolls shed did so within three of four days after flowering. From a statistical examination[6] of 579 shed bolls at Auburn, Ala., it emerged that the distribution of shed bolls, according to age, shows that the vast majority of bolls are shed at the ages of from three to seven days inclusive, and have at shedding a diameter of 12 mm. or less. In fact, 95 per cent. are shed before the end of ten days. (Figure 2).

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[5] With various form of dehiscence this paper has nothing to do.

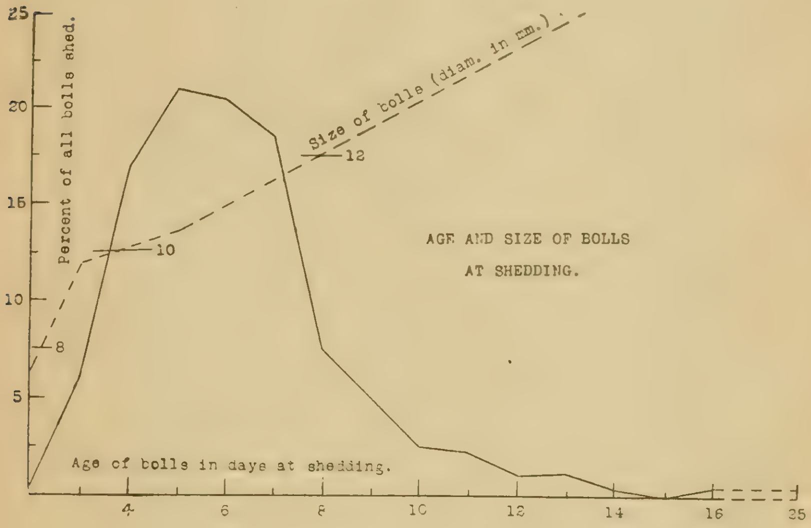

Figure 2. Graphs for age and size of bolls at shedding in percentage of the total shed. (*Gossypium herbaceum*).

The so-called "shelling" of grapes, which may greatly reduce the crop just at the period of maturation, appears to be the result of a definite abscission process comparable to the shedding of the cotton boll, except that the plane of separation occurs at the base of the ripened ovary and not at the base of the pedicel.

There are instances of indehiscent fruits in which exceptional behaviours may be seen, of which that of *Polygonum virginianum* and of the wild rice (*Zizania* spp.), may be quoted.

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[6] Based upon data collected by my then assistant, Mr. C. S. Ridgway, who has kindly referred them to me.

The former, according to Reed and Smoot (16) is peculiar in having a layer of compressed pith cells enclosed in the vascular cylinder which remains unbroken until touched, although the cortex already shows complete abscission. Impact sufficient to break the vascular tissue allows the expulsion of the fruit, to a considerable distance. Those who have become familiar with the wild rice recall the fragile character of the stem below the spikelet, which breaks away at a slight touch. It needs not to do more than recall the various behaviours of plants which, like the compositae, set free their one-seeded fruits, sometimes singly, as in *Adenostemma* (Yapp, 17) and indeed in the majority of the family, and sometimes in groups, as in *Parthenium*, in which each of the five achenes is accompanied by two sterile flowers, while all the remaining staminate flowers are set free *en masse* (Lloyd, 8).[7]

Since the abscission of flowers and fruits results from a transverse or oblique cutting off of the stem, we should expect that the plane of separation would fall at or near the base of an internode. According to Hannig, however, this takes place immediately beneath the flower at the top of the pedicel in several species (*Nicotiana*, *Salvia*, etc.), and in the middle of the pedicel in others (*Solanum*, etc.). In still other species, the abscission plane falls just above a very small bract, these, therefore, according with the general rule. It may be mentioned in this connection that while separation near the base of the chief axis of the inflorescence may take place (*Mirabilis* and *Oxybaphus*, Hannig; *Impatiens Sultani*), it is no less worthy of note that, in many plants, even after the usefulness of the inflorescence has passed, their chief axes remain as permanent encumbrances. I have been able to find the traces of them in *Parthenium argentatum* after the passage of five years or longer. Among our own plants one easily finds similar examples, *e.g.*, *Rhus*, *Negundo*, *Syringa*, etc. And there are very many plants (palms, agaves, ferns, etc.) to which the leaves cling indefinitely, until they are worn or rotted away.

A case requiring special explanation is to be found in the Cotton (*Gossypium*), in which the plane of abscission may pass transversely through the base of the pedicel, or may extend downwards along the internode below, even as far as the next node. The diagram (Figure 3c) presents these diversities in graphic form. It has long been a puzzle to those concerned with this plant to account for this peculiarity, recorded in a bulletin on the diseases of the cotton by Atkinson (18) in 1897. To

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[7] The separation of such parts may be passive and involve no special abscission mechanism of living cells.

understand it, the morphological character of the flowering branch, as modified by dorsiventral development and by disharmonic growth in a longitudinal sense as between the upper and lower moieties of the axis, must be comprehended. The flowering branch is sympodial, but this is frequently much masked by displacement due to elongation of the nodal segments. That such elongation occurs is proved by the position of the stipular ridges[s] and occasionally by the actual longitudinal renting in twain of the stipular blade, and the distant separation of its two moieties by intercalary growth in the axis. In extreme cases of this kind, what appears to be an internode is really a much extended node, in which event the peduncle, which is the chief shoot, will be downwardly displaced as a whole (Figure 3a) (it may be to the lower limits of the stipular ridge), or its base will be correspondingly drawn out (Figure 3b). If

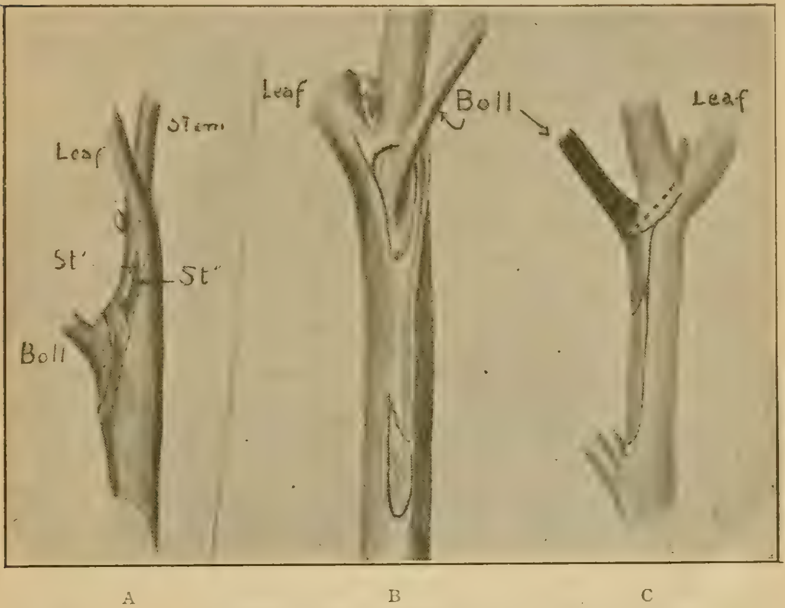

Figure 3. (a) The position of the abscission layer in the peduncle of cotton when it is downwardly displaced; (b) the same when, instead of total displacement, the base of the peduncle is elongated; (c) diagram to indicate possible positions of the abscission layer as determined by the elongation of the peduncle base. In (a) and (c) the stipule of the hidden side is indicated by a broken line. (*Gossypium herbaceum*).

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[s] Cook, O. F., (20) has discussed this point, but does not draw any unequivocal conclusion, inclining the view that the flowering branch is monopodial, which myself found it difficult to avoid, until the evidence forthcame.

this displacement does not occur, the abscission plane of the peduncle is transverse through the base; if displacement has intervened, the abscission plane runs down the false internode, as it may be called, and, in extreme instances, as far as the node below. It should be stated that the displacement in question is always greater on the upper side of the dorsiventral shoot in such a manner as to cause a slight axial rotation of the peduncle. We must, therefore, conclude that abscission in the cotton is always through the base of the peduncle, and when it is decurrent it is so because the base of the peduncle is stretched out in consequence of the extension of the nodal zone. The position of the plane of separation is marked by a low ridge. There is, indeed, especially visible in flower buds and quite youn gbolls a slight groove parallel and close to the base, but this has no constant relation to abscission, contrary to Ball's statement.

THE ABSCISSION OF FLORAL PARTS.

The separation of the parts of the flower may, on similar grounds, be compared with that of the leaf. It occurs normally toward the close of anthesis, and, indeed, may be taken as its index, just as the unfolding of the flower-bud marks the beginning of this critical period. The whole matter is too complex and varied for brief presentation, so that it must suffice to make a mere summary. With the culmination of flowering, any of the organs taken separately, or any structural segregate of them, may be found to fall away. The sepals (*e.g.*, in *Sanguinaria Impatiens*, *Cruciferae*, etc.), petals, stamens, anthers or styles may do so, or the corolla as a whole in the sympetalae, or the corolla and androecium in one piece (*Malvaceæ*) synchronously with, but independently of, the style, and so on. Conversely, these parts may be variously adherent, and wither *in situ*, affording another case of disharmony. Witness the frequent adherence of the calyx (Rosaceae), of the androecium (Leguminosae) and even the corolla (*e.g.*, many Orchids, etc.), specific instances being afforded by the previously cited *Cereus Thurberi* by *Echinocactus Emoryi*, and by *Habenaria* among the orchids.

The position of the abscission plane, as in the leaf, is near the base of the organ or complex of organs involved. Its direction is, however, subject to more variation than it is in the leaf, and may run much more obliquely. For example, this direction in the corolla of the cotton flower varies from transverse (which is rare) to an obliquity of 45 per cent., which is usual. The style of this plant calls for special notice in this connection. Separation of this organ begins during the second afternoon of anthesis, and may usually be detected at about 3 o'clock. But instead of being confined to one level, it occurs at several, so that one may describe the process as a fragmentation of the lower part of the style. In the course of a short time, the raw edges of the fissures become brown by oxidation, thus discovering them to the eye. The separation of the corolla proceeds at the same time, although the actual cadence is evident only on the following morning. The abscission plane in the tobacco corolla is irregular and lies a millimeter above the base of the tube (Kubart, 19), while in the epigynous forms it is found above the ovary, and so not at all near the morphological base of the elements of the corolla.

It is only rarely that in leaves there is any externally visible structural indication of the position in which abscission will ensue, and it frequently happens that grooves which are sometimes taken for such indications bear no relation at all to the process. It is probable that in the case of the corolla, or of the individual petals, it is more frequently the case that a more constricted region is made use of. Fitting points this out especially in *Geranium*, *Erodium*, etc., describing it as an extremely narrow, isthmus-like reduction of the blade—a very usual condition. Nevertheless, such a reduced region is entirely wanting in many other species, so that it seems hardly probable that there is any necessary connection between the two phenomena.

PERIODICITY IN ABSCISSION.

We consider, under the head of periodicity, more especially that of leaf abscission. It is true that external conditions affect also that of floral organs, and, to the careful studies of Fitting (20) and Hannig (12) more especially, reference will be made beyond. The apparent synchrony between the fall of the leaf and the end of the growing season being the most widely recognized, it is convenient to discuss this especially.

I say apparent, since, in a large measure, we are deceived in temperate and boreal regions, as well as in the tropics, by the continuity of verdure in its entirety. The constant dying-off of leaves escapes attention, albeit a little careful observation will discover the fact. During, or soon after, the unfolding of the buds in spring, the bud-scales suffer abscission, and as the new shoots advance in age the earlier formed leaves in their turn drop off. Nevertheless, the majority of the leaves produced during the season are, under normal seasonal conditions, shed within a rather short space in the autumn, the exceptions to this rule being the so-called evergreens, in which the life of the leaf is extended over a longer period, namely, two seasons or more. Obviously, in these the longevity of the leaf is predominant, seasonal responses being seen in the growth of stem and new leaves in the spring. In the tropics various factors may be effective at various times, which may also be said of the warmer desert regions, where rain may induce the production of foliage at any time of the year. (*Fouquieria*, Cannon, 22).

The loss of foliage in areas of marked seasonal change is a response to environmental stimuli, found in conditions which are usually and on the whole unfavourable for growth or for the physiological processes which take place in the leaf. If it happens, as in exceptional years it will, that such or analogous unfavourable conditions intervene at unusual times, general defoliation will ensue just as promptly and completely as at the usual time. Only last year (1913) in Nebraska, an almost unprecedented period of high temperatures and meagre rainfall, together with low relative humidity, caused, in addition to a far-reaching prejudice to crops, a marked shortening of the usual vegetative period. Herbaceous plants hastened to fruitage, and "early leaf maturity and leaf fall was common among native and exotic forest trees." During the late summer, after the drought had been broken, refoliation occurred, but the new leaves were small (Pool, R. J., 23). Klebs (24), cites a similar occurrence in Germany during the summer of 1910, caused by dryness in July and August, followed by refoliation, and speaks of the case as a natural experiment on a large scale to support his contention that the periodicity of trees expressed in leaf-fall is a response to external conditions, and not, as Volkens (25) has argued, especially in regard of tropical plants, a periodic phenomenon independent of the external environment, and dependent on inherited and inherent causes. The basis for this view was Volkens' failure to observe any relation between the march of climate and defoliation, as, *e.g.*, in *Ficus fulva*. Klebs insists, however, that the time of defoliation may be shifted by disturbance in surrounding conditions, and cites, among others, the fact that tropical plants could be made to shed their leaves in the very short time merely by a reduction of light.

However the attack on this problem may turn out, it is worth while to indicate that a conclusion, such as Volkens arrives at, is a sort of mental anæsthetic, which, like the vitalistic theory, lulls the mind and inhibits vigorous and critical attack. As Klebs very rightly puts it, every life-process depends in some degree upon the external world, and it is only by experimental methods that we can hope to come at a right analysis of this complex relation.

(To be continued)

A PLEA FOR THE PUBLICATION OF A NEW ILLUSTRATED FLORA OF THE PROVINCE OF QUEBEC.

In the annual report of "The Quebec Society for the Protection of Plants" for 1911-1912, the following statement appears: "Many years ago Abbé Provancher published a work entitled '*Flore du Canada*' in two volumes, which has been out of print for some years, and is now very difficult to procure. No work on systematic botany has taken its place in Quebec, consequently this phase of the study of plant life has been, to a large extent, neglected in the French schools of the province. I would, therefore, suggest that the society request the Government of the province not only to reprint a revised edition of Provancher's work, but also to publish a school edition of the same. The publication of these two editions would give a stimulus to the study of plants, and indirectly would tend to a better knowledge of weeds on the part of the rising generation."

As an admirer of Abbé Provancher, and one who, moreover, has followed closely in his footsteps for the past ten years, I beg leave to express an opinion on the matter.

There is no doubt that the name of Provancher has a prominent standing in the history of Canadian science. Under struggling circumstances, without special training or laboratory facilities, far from technical libraries, he, however, accomplished a stupendous amount of work and cleared the ground most efficiently for future workers.

The "*Flore Canadienne*" was a most extraordinary achievement for the time, and, although fifty years have passed,—fifty years of feverish activity—even though it is now largely obsolete on account of the steady advance in botanical studies, we must admit whatever our language is that no other book, as yet, has attempted to displace it.

Nevertheless, the proposal of reprinting Provancher's work is a rather sad acknowledgment of inability; to state my opinion briefly, I consider that such a reprint, if the essential features are preserved, would be a step backwards.

In the course of the last half century the systematic botany of North America has benefited by the labour of a host of serious workers. Unknown regions have been penetrated, thousands of new species established and the nomenclature more than once disturbed and subjected to new investigations.

Mentioning only the Province of Quebec, the careful survey of Prof. M. L. Fernald and his Harvard friends has shown, in the Gaspé Peninsula, the existence of an altogether unknown flora akin to that of the Rockies. Of this fact, of course, Provancher had no suspicion.

Such genera as *Isoetes*, *Potamogeton*, *Juncus*, *Carex*, *Rubus*, and especially *Crataegus*, have revealed an amazing wealth of species. Everybody knows the hawthorn, and appreciates it more or less, but very few would suppose that the American species now number about 1,000. The joint work of C. S. Sargent and J. G. Jack have shown the limestone ridges of Montreal and the contiguous shales to be one of the richest regions in the whole world in forms of *Crataegus*. Although there is much yet to do in the genus, it can already be foreseen that the new Flora of Quebec will be bound to include as many as 60 or 70 species.

I do not wonder now about my perplexities while first trying to separate the Longueuil *Crataegi* with Provancher as a guide. It was only when I opened the pages of the seventh edition of Gray's Manual, and when I was made acquainted with Mr. C. S. Sargent, that I began to understand something regarding them.

Provancher believed the distribution of plants in Canada to be zonal, according to latitude, and, consequently, to be approximately identical from the Atlantic to the Pacific: this belief he had in mind when he entitled his work "Flore Canadienne." This generalization has not proved successful. We know to-day, by the collections of Macoun and others, that the prairie region, the Rockies, the Pacific slope, have each a distinct flora, and a "Canadian Flora" embodying the whole of the territory, would be an immense enterprise.

Properly speaking, Provancher covers but the central portion of the Province of Quebec. The list, with analytical keys, annexed by Abbé Moyen to his own "*Traité de Botanique*," though more complete, is yet fragmentary, and must undergo the very serious criticism of lacking the descriptions necessary to every one except the trained specialist.

I think that the demand is for a new "Flore Illustrée de la Province de Quebec," embodying the Ungava territory, and brought up to the present state of botanical science.

Such a publication is no easy task. Difficulties are numerous, and foremost among them would be the cost of production, including the necessary illustrations. These latter alone would cost a large sum. I hardly think that any private enterprise in this line would be possible. It seems that the Provincial Government should take charge of the work, through one of its departments, subsidizing it as the work goes on.

BROTHER M. VICTORIN,
of Christian Schools.

Longueuil College, P.Q.,
March 24th, 1914.

PUBLICATIONS OF THE CARNEGIE INSTITUTE OF WASHINGTON LATELY PLACED ON THE SHELVES OF THE REFERENCE ROOM, CARNEGIE PUBLIC LIBRARY, OTTAWA.

Botanical Features of the Algerian Sahara. By Wm. A. Cannon.

Handbook of Indians of Canada. Ed. by F. W. Hodge.

Determinate Evolution in the Color-Pattern of the Lady Beetles. By R. H. Johnson.

Studies in Heredity as Illustrated by the Trichomes of Species and Hybrids of Juglans, Oenothera, Papaver and Solanum. By Wm. A. Cannon.

The Conditions of Parasitism in Plants. By D. T. Macdougal and W. A. Cannon.

Studies of Inheritance in Rabbits. By W. E. Castle.

Distribution and Movements of Desert Plants. By V. M. Spalding.

THE CARDINAL GROSBEAK IN WINTER IN NORTHUMBERLAND COUNTY, ONTARIO.

A specimen of the Cardinal Grosbeak was observed at Brighton, Northumberland County, on the morning of February 22nd last. The day was very cold, with strong wind and snowdrift. The bird was quite tame, and was evidently a female on account of lack of bright plumage. Those who called my attention to the bird did not recognize it, neither did I at first, never having seen one alive in a wild state. I suspected the species, however, on account of the large, ivory, reddish beak and a red cast in the plumage and in the tail feathers. On my return home I looked up the description of the species, and was at once satisfied that I had diagnosed it correctly. I suppose this is about as far east an Ontario record as we have.

I may mention that the migration of Warblers in this section this spring has been an exceedingly slim one. I have seen scarcely any in their usual haunts—only the yellow and one other.

C. J. YOUNG,
The Rectory, Madoc, Ont.

REVIEW OF A REVIEW.

To the Editor of THE OTTAWA NATURALIST:

It is to be regretted that the *slips* alluded to in a review of the "Check List of the Fishes of the Dominion of Canada and Newfoundland," in the May issue of the NATURALIST, are not pointed out by the reviewer. In the *introductory remarks* of the book it is stated that "it is subject to amendment in regard to species to be added to the list as records or discoveries reveal them; and not only so, but in regard to species, and such are apparently few, to be eliminated from the list as having no right there." But that given by "C," as an instance of an *occasional slip*, can hardly be regarded in that way, because the occurrence of *Thymallus tricolor montanus* is queried in the text, and the foot-note does not suggest that the so-called grayling *is*, as "C" puts it, that species, for the words are these: "A little salmonoid in rivers of southern Alberta, locally called the grayling, *may be* this sub-species." Besides, even if this salmonoid turns out to be a species of whitefish (*Coregonus williamsoni*), as "C" says the Alberta Fishery Commission stated distinctly, and not a grayling at all, yet as *Thymallus tricolor montanus* occurs over the Albertan border, in Montana, its mention in the list, with a query, is quite in keeping with what the list purports to be, as is explained by the following remark in the introduction: "Species which occur close to our borders . . . . although not actually recorded from our waters, are provisionally admitted." This is what has been done sometimes in other lists of the kind, and thereby a purpose may be served in stimulating research on the part of any who seek to ascertain what the entire geographical range of a species in particular may be. It might then be hazardous for "C" to state positively that the Montana grayling does not occur in southern Alberta lest it might be found there, and its provisional mention with a query in the list does not, therefore, appear to be amiss. Indeed, it is quite likely to be found north of the United States boundary, for it is doubtless a post-glacial survivor, and the clear, cold streams of southern Alberta, flowing down as they do from the mountains, seem well adapted for the requirements of this little fish as a habitat. If, then, *slips* occur in the list, that singled out by "C" as an *example* does not seem well chosen.

The book itself must stand or fall according to its merits, and if it is lacking "in completeness of matter" and in "compact description and arrangement" it has, nevertheless, been complimented by eminent authorities and has been applied for widely by naturalists. In point of fact, it was never meant to be descriptive, so that to dispute its value because it affords no information concerning "the spawning period and the nature of the eggs" is surely beside the mark. The aim of the book is uniformity in its subject matter, not description, and its object is clearly stated in the introduction as the following quotation will show: "The technical name, governed by the rules of priority; the vernacular name when the fish has one . . . .; the environment concisely, and the geographical distribution of each fish are given."

Concerning the figures, if "C" had examined the specimens in the Canadian Fisheries Museum, from which the photographs which he criticizes were taken, he would have seen that the majority of the figures are from mounted specimens of the fishes themselves—a minority only being from casts (which, moreover, are actual impressions of specimens), viz.: the steelhead salmon and the five species of *Oncorhynchus* of the Pacific slope; whereas "C" says they "are in *very many cases* from defective coloured casts." [*Italics mine*].

ANDREW HALKETT.

A WELL-EARNED HONOUR.

Many members of the Ottawa Field-Naturalists' Club learned, with much pleasure recently, that the University of Toronto had conferred upon Mr. F. T. Shutt, M.A., F.R.S.C., Assistant Director of the Experimental Farms and Dominion Chemist, the degree of Doctor of Science. Mr. Shutt has always taken a keen interest in the work of our Club, being for many years a valued member of the council. From 1892 to 1895 he was vice-president of the Club, and during the years 1895 to 1897 he occupied the office of president. It was with appreciation, therefore, that notice of such honour reached us early in the present month (June). The degree was conferred on June 5th.

Such an honorary degree, when it comes to one who has really accomplished valuable results in science, is indeed worth having, and not only honours the one receiving it, but also honours the seat of learning conferring it. In the present instance, we think the University of Toronto has chosen wisely. Dr. Shutt, during the last 27 years, has given the best part of his life to a study of the science of chemistry in relation to agriculture. His researches towards the economic maintenance of fertility of soils and the factors that influence their nitrogen content; in the composition and relative values of Canadian grown fodders and feeding stuffs; on the influence of environment on the composition of cereals; on the nature and values of insecticides and fungicides; on the suitability of various districts throughout Canada for the growth of sugar-beets; on the quality of Canadian waters as occurring in lakes, streams and springs, etc., have given results of far-reaching importance.

Dr. Shutt has published many papers of a scientific character in various journals and publications and has lectured before many important societies. The results of much of his work has appeared from year to year in the annual reports of the Experimental Farms and in special bulletins which he has prepared.

In 1885, Dr. Shutt received the degree of Master of Arts from Toronto University, and for about two years was Demonstrator in Chemistry at his alma mater. In 1887, he was appointed chemist to the Dominion Experimental Farms, and in 1909, owing to the widening field of work, his title was changed to Dominion Chemist. In 1911, the added responsibility of Assistant Director was given him.

Dr. Shutt enjoys fellowship in the Institute of Chemistry of Great Britain, the Chemical Society of England and the United States, the Royal Society of Canada and the American Association for the Advancement of Science.

The members of the Ottawa Field-Naturalists' Club, who have the privilege of knowing Dr. Shutt, will feel a deep sense of pleasure in the conferring of this well-earned honour, and we take this opportunity of extending to Dr. Shutt our congratulations and best wishes for a continuance of the very useful work he is doing in the upbuilding of Canadian agriculture.

A. G.

EXCURSION TO ROCKCLIFFE.

The first excursion of the season was held at Rockcliffe on Saturday afternoon, May 2nd. Mr. Arthur Gibson, President of the Club, presided, and the following leaders of branches were in attendance:—Entomology, Messrs. Gibson and Sladen; Geology and Ornithology, Dr. Williams; Zoology, Mr. Halkett; whilst the Botanical Branch was represented by Mr. Carter, a member of the Council. After exploring the park, the excursionists assembled at the log-cabin, where short addresses were delivered by the leaders.

Dr. Williams told about the bird-boxes which have been placed in trees of the park for nesting purposes by the Ottawa Improvement Commission, under the direction of the Club.

He then spoke of the birds which had been observed, which were these: A sharp-shinned hawk, a northern flicker, a herring gull, numerous examples of the American crow, several American robins, and presumably a pair of song-sparrows, the observation of which was not favourable enough for definite determination. Judging from the size of the sharp-shinned hawk, Dr. Williams considered it to be a female, and that it evidently was hunting for small birds. It flew past the party several times and, according to him, its speckled brown breast, short wings and comparatively long tail were sufficiently well noted to identify the species. He remarked also on the perching habits of the flicker (an unusual thing among woodpeckers), and the example seen alighted on a dead branch near the top of a tree and afforded an opportunity to several members of the Club to observe it carefully through field-glasses. Other names applied to the northern flicker, given by Dr. Williams, are: The golden-winged woodpecker, the high-holder and the yellow-hammer; and besides the birds, he also spoke about the geological features of the park.

Mr. Carter spoke about certain of the trees in the park, viz.: White pine, hemlock spruce, balsam fir and white cedar. He described the leaves of the trees, remarking that those of the white pine are long and needle-shaped, five in number, and spring from a common centre; those of the white spruce are short, stiff, needle-like, four-sided, pointing in all directions; while the leaves of hemlock spruce are flat, lighter in colour beneath, and pointing in two directions only. The leaves of this latter are quite soft and are often used by campers and hunters to make camp beds. Unlike the white pine and the white spruce, the cones of the hemlock spruce are persistent. The leaves of the white cedar are in four rows on the two-edged bracklets and so closely packed and overlapping each other as to resemble shingling. The cones are persistent, with the scales pointless and seeds broadly winged all round.

Mr. Sladen, followed by Mr. Gibson, spoke of the insects observed during the afternoon, the former chiefly of a specimen of solitary bee, and the latter of two species of butterflies, the Mourning Cloak and the Large Tortoise-shell, both of which hibernate beneath logs, flat stones, or other objects which afford shelter during the winter months. Specimens of the Hedgehog Caterpillar were collected and the life habits of this arctian, or woolly-bear, described. Interest was also shown in the young tent caterpillars, which were about to hatch from the egg-clusters on the trees.

A. H.

BOOK NOTICE.

ANIMAL COMMUNITIES IN TEMPERATE AMERICA. A study in animal ecology—designed to serve as a reference work and text-book. By Victor E. Shelford, Ph.D., of the Department of Zoology of the University of Chicago. Illustrated with 300 figures, maps and diagrams; 380 pages, 8 vo, cloth; price, post-paid, $3.22. University of Chicago Press, Chicago, Ill.

A copy of this recently published book has been received. Following the introduction, the work is divided into fifteen chapters, in addition to which there is an Appendix (methods of study), a Bibliography, an Index of Authors and Collaborators and an Index of Subjects. The chapters are again divided into sub-sections, as, for instances, Chapter I on "Man and Animals" —i, Introduction; ii, The Struggle in Nature; iii, Man's Relation to Nature; iv, The Economic Importance of Animals. Chapter II on "The Animal Organism and the Environmental Relations"—i, Nature of Living Substance; ii, The Relation of Form or Structure to Function; iii, The Basis for the Organization of Ecology; iv, Scope and Meaning of Ecology; v, Communities and Biota; and so forth.

The book, which is designed to serve as a reference work and text-book, is indeed a most valuable contribution to the subject of field ecology. The material used by Dr. Shelford in the preparation of the volume has been accumulated during ten years of field-study, from the view-point of modern ecology, in various parts of the United States, though most of the material is drawn from the Chicago region. The habitat records include: Lower Invertebrates, 32 species; Mollusca, 95 species; Crustacea, 54 species; Spiders and Arachnids, 80 species; Insects, 457 species, divided as follows: Aquatic Insects, 52 species; Orthoptera, 53 species; Hemiptera, 100 species; Coleoptera, 175 species; Lepidoptera, 30 species; Diptera, 47 species; Fishes, 75 species; Amphibia and Reptiles, 27 species; Birds, 85 species; Mammals, 28 species.

Much care has been exercised by the author in choosing good illustrations to represent the various types of animal communities and their characteristic modes of life. The printing and the paper used in the book are excellent and the whole subject matter presented in a most interesting manner. Canadian students should find this book of much value in connection with their work.

A. G.

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ABSCISSION.

By Francis E. Lloyd.

(Continued from page 52)

This dependence upon external conditions is frequently illustrated by the behaviour of plants in temperate and boreal regions. The weather conditions about Montreal during October and November of the year just past (1913) were peculiar, and they were reflected in the behaviour of shrubs and trees. Many of them began to push out their spring flower buds, and in some instances (*Hydrangea*) partially opened their flowers, while the usually prompt disappearance of foliage in many trees and shrubs was much delayed. The poplars were especially noticeable, retaining their leaves even in exposed situations so that many were retained far into November, while a few still remain at the present writing. *Ampelopsis Veitchii* was also noteworthy in this respect, the conditions having been such that, in some cases, a full half or more of the leaf complement still remains adherent, though dry and dead (February, 1914). I examined these plants and found that the process of abscission had been started, but had been prevented from completion.[9] Perhaps, having been delayed by the unusual prolongation of warm weather, the abscission was overtaken by a sudden change and stopped by killing the leaves, whereas, normally, the abscission would have been completed before such intervention. It is possible that an examination of such trees as the black-jack oak, which often fails to shed its leaves, would throw light on this habit. A red beech, planted on the campus of McGill University, constantly retains its leaves, but those especially on the shorter lateral shoots. According to my late colleague, Professor Alcock, this tree shows each year an increasing tendency in this direction. I am able to confirm this observation as regards 1912 and 1913. This last year, the plant has retained practically all its leaves except those on the outermost new shoots. It would have occasioned less surprise if the change in tendency of leaf shedding has moved in the opposite direction. I find in this plant also, that a partial abscission layer was formed.

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[9] Tison found that the marcescent leaves of Hamamelis differed from the normally caducous in having an incomplete abscission mechanism or it is not even initiated.

The indefinite prolongation of green foliage in plants which show definite periodicity in temperate regions is not difficult to attain under experimental conditions. Flammarion (26) caused seedlings of *Quercus robur* to retain their leaves by transfer to a greenhouse. By removing the lower leaves from a shoot, Dingler (27) was able to postpone abscission of its upper leaves The age of the organ thus enters in as a factor. The cotton plant in the open field begins to show a decreasing activity in mid-summer, even in mid-Alabama. The exact date in 1911 at Auburn was August 14th. When kept under constantly favourable conditions, as in a greenhouse, its period may be prolonged very greatly. I have grown it for over a year, without any evidence that it could not have been kept in activity for a still longer period. The guayule, *Parthenium argentatum*, and its congeners, *P. hysterophorus*, *P. lyratum* and *P. incanum*, may be similarly controlled. The shrubby species show a periodicity related to rainfall in their natural habitat (the Chihuahuan Desert), but it was found possible in the driest part of a very dry year to stimulate the plant to renewed growth by cutting back the branches, thus showing that the moisture supply alone was the limiting factor, and when the balance between outgo and income was disturbed in favour of the latter, growth became possible. *Ampelopsis Veitchii* normally sheds tendrils only at the close of the season, but I found them being shed during dry weather from plants which spread over boulders (New York Botanical Garden, July, 1913) and were so exposed to high temperature and isolation. Such examples very much strengthen the view that the periodic phenomena of growth and leaf-fall stand in a delicate relation to the environmental factors, a disturbance in any one of which is sufficient to induce a change in behaviour. The analysis of this relation is possible only, as Klebs has said, by experimental means. We may, therefore, profitably examine this aspect of our problem, in order to see what results are at present available.

THE RELATION OF ABSCISSION TO EXTERNAL FACTORS.

The intricacy and much detail of the work which has been done, far too little as it, at present, may be, will prevent more than a rather curtailed summary, but sufficient, it is hoped, to direct attention to the chief results.

Transpiration. It has been a readily attained and rather generally accepted view that the abscission of leaves may be induced by disturbances in the water relations. The promptness with which many desert plants lose their foliage with approaching drought and their readiness to refoliation, even though stimulated thereto by such moisture as might be absorbed by their branches from rain (Lloyd, 28), as I have shown experimentally to be the case in *Fouquieria*; the dropping of leaves by houseplants on too meagre or too generous watering, both go to show that, directly or indirectly, such conditions may induce abscission. The early shedding of tendrils in *Ampelopsis*, above cited, may have been due to excessive transpiration. That merely reduction of water content of the leaf is, however, inadequate, in itself, to produce the result is shown by the fact that daily "incipient drying" and actual wilting, which we know from observation (Lloyd, 29), (Livingston and Brown, 30) to occur, is not followed by any such result. Desiring to produce abscission by reducting the water supply to organs known to be able readily to be caused to shed, I did the following experiments: A large sector (90°) of tissue was removed in a dozen cases from the stem below the insertion of the tendril in *Ampelopsis Virginiana*, and it was found impossible to induce abscission, although it will occur in cut branches in 36 or 48 hours in a moist chamber, without measureable loss of turgor, though doubtless there was some. The wounds healed, and they were later examined microscopically, and all the vascular supply to the tendrils was found to be extirpated for a distance of 5 to 10 mm. The water supply must then have passed around the wound, travelling laterally below and above it, yet either without the least prejudice to its movement or quantity, which is difficult to believe, or, if such prejudice obtained, without inducing abscission.

For some time I held the view that the peculiar anatomical relation in the flowering branch of the cotton was responsible for much of the boll-shedding. The view had been expressed that the shedding of fruit by orchard trees, said more often to occur near the ends of the branches, is due to the more favourable position of the proximal, since these are nearer the source of supplies.[10] The occurrence of the vascular tissue in an organ of limited secondary thickening (the flower-stalk) alongside that in one of unlimited secondary thickening, namely, the functionally chief axis, seemed to supply a possibility for an increasing prejudice to the water supply of the boll as growth of the whole shoot proceeds. Indeed, the much more restricted secondary thickening of the vascular tissues to the boll strengthened my belief. But experimental evidence is all against it. I removed large sectors of tissue from the axis below leaves and below bolls, in twenty cases[11] on August 19th. On the 21st one boll was shed, but the injury had been made beneath the corresponding leaf. On the 22nd one, and on the 23rd two bolls were shed, the injury having been made beneath them. After this there was no shedding till the 28th, when two more bolls fell, beneath which the operation had been done. In no case was the leaf affected, and the shedding of bolls later than August 23rd must in any event be excluded. The bolls were all small when shed, as the operations were done when the flowers were open. It can be shown that the number of losses is accountable for in other ways, and we must conclude that disturbance due to wounding is absent.

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[10] Sorauer, P. Abwerfen der Früchte. Handbuch der Pflanzenkrankheiten.

On the other hand, Balls (33), working in Egypt, was able to cause practically complete shedding of leaves, flower-buds and bolls within four days by pruning the roots, and so limiting the ability of the plant to take up water. I have repeated the experiment with positive, but less striking and perhaps not unequivocal results, in North Carolina. Cultivation, which unavoidably causes some damage to the shallower lateral roots, is believed by planters to be responsible in part for shedding. Such treatment as root-pruning is certain, if at all extensive, to cause visible wilting in an unusual amount, and too great a loss in this manner may interfere with the mechanism of abscission. It would seem that, if a reduction of water activates the process, it must be when only in a small measure, such as we may suppose happens in cut branches when kept in a moist chamber, a method which was used even by von Mohl (34) in his studies. The relation is, at the present moment, a puzzling one. In the case of flowers, Hannig was unable to find any effect on the rate of abscission beyond that of ordinary laboratory air, buds, open flowers and young fruits falling away equally rapidly in both. Fitting arrived at the same conclusion, from which we may argue that the greater loss of water by evaporation, supposedly attributable to drier air, has no effect on the abscission of the corolla. This organ is, however, especially resistant, as is shown by the fact that a cotton flower-bud, removed on the evening before opening, will open and remain turgid on a laboratory table for an entire day, even though the bracts and calyx wilt and even wither. And I have observed that the petals of desert plants (e.g., *Sidalcea*) remain turgid while the whole plant shows marked wilting during the hottest period of the day. The fact that abscission may occur under water (poplar, maple, horse chestnut, etc.) is, of course, to be accounted for in some other way than reduction of water.

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[11] Exp. 11, West Raleigh, N.C., Aug. 19th, 1913.

In general, therefore, we must conclude, in view of the effects of drought upon trees and shrubs, that there is a relation between lack of water and defoliation, but it is not possible to attribute abscission directly to a reduction of water content, such as may be measured. It may, however, result indirectly by the disturbance of some other relation. As we shall see, very slight departures from the normal condition of the environment in other regards are sufficient to cause or to hasten abscission.

MECHANICAL CAUSES OF ABSCISSION.

This apparently indirect effect is further exemplified in the abscission response to mechanical stimuli. For convenience we regard as mechanical, stimuli such as shaking and wounding, though we cannot consider these as working directly.

Shaking. It is to Darwin (35) that we owe the observation that, if the flower stalk of the mullein (*Verbascum*) is sharply jarred the corollas will presently fall off. Fitting, having satisfied himself that the falling of the corolla was not due to accident or to the movement of the calyx, as held by Devaux, found by repeating Darwin's experiment, that separation was consummated in from 45 seconds to 5 minutes, but for the most part in from 1 to 3 minutes. This is equally true of young and older flowers, so that it is not due to their age. He found a similar behaviour in *Geranium pyrenaicum*, with a reaction time of from 30 seconds to 6 minutes. This phenomenon has been little studied, and only few plants are known to show it.

Wounding. The importance of the effect of wounding on abscission will at once be realized in view of the great economic losses occurring each year from the dropping of buds, flowers and fruits from the plants of our orchards and gardens, as a result of insect and other injury in the form of wounds. Young peaches, when wounded by curculio, drop. The great loss to cotton growers in Alabama, Louisiana and Texas, and the great financial disturbances accompanying it, caused by the boll-weevil, to which must be added the immense expenditures involved in scientific research in finding a way out of the difficulty, have caused a highly dramatic interest to attach to the problem. This case will serve, therefore, as a good example for the present discussion.

The boll-weevil lays its egg in a young "square" or flower bud. In from 1 to 22 days[12] the square falls to the ground, the average time being from 8 to 10 days. A very peculiar feature, but following also on other causes, occurs in squares just previous to falling, namely, an outward movement of the bracts (flaring). Sometimes, if abscission does not intervene, the bracts will move inwardly again. This movement is of very great theoretical interest, since it indicates that there is no lack of turgor (though it does not prove it), and, if this be true, an undue loss of water, it is probable, is not a factor. It is evident, from the data which are at hand, that there is some relation between the amount of injury and the time which intervenes between the first insect puncture and the final separation, since, by means of other experiments, I have found that it is possible to cause the abscission of 100 per cent. of young bolls by means of suitable injury (a transverse cut across the ovary), within 48 hours, and 90 per cent. have been shed within 24 hours in one series. "Squares" (flower-buds) are not so sensitive, shedding 35 to 55 per cent. in 36 hours; 40 to 75 per cent. in 48 hours, and the rest later.

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[12] I am indebted to the United States Bureau of Entomology, through the courtesy of Dr. L. O. Howard and Dr. W. D. Hunter, for the use of valuable data on the shedding of bolls after weevil injury.

Larger bolls respond only after a longer period, namely, in from 3 to 6 days, or not at all if too large, though they may die without becoming detached. From this we see that a point of development and induration of the tissues of the peduncle may be reached when abscission is not more possible.

Shedding of the very young bolls may also be caused by cutting off the style before pollination, but this, as Fitting found in *Geranium* and *Erodium*, depends on the absence of pollination. In *E. Manescavi*, the petals fall away much sooner after the style was injured than in the uninjured flower. Hannig also found that cutting off the petals, stamens or stigma, from unpollinated flowers, and still more readily by removing the ovary, before or after pollination, caused abscission of the whole flower. Wounding of the peduncle did not do so if a portion of the tissue was left, indicating, as I have above shown, that a reduced amount of vascular tissue was able to carry on the function of the whole.

Much has been said about the effect of the wounding of leaves by cutting off the blade, and it is generally believed that such injury causes abscission. The results thus obtained are, however, very inconstant and uncertain, as I have found in my own experience. Only a single example. I cut off the petiole (in *Ampelopsis*) from one leaf 10 mm. from the base, and allowed the next lower leaf to remain. The latter separated in 24 hours (in a moist chamber), while the stump of the cut petiole remained attached. I have done similar experiments with other species with like results, and I have observed injured leaves in nature, finding them to adhere just as long and firmly as uninjured, in many cases. We must therefor say, as Hannig has, that wounding as such does not induce abscission, but works in a round-about way.

THE EFFECT OF TEMPERATURE UPON ABSCISSION.

The occurrence of abscission at the time of the year when the cold is increasing, and the dropping of leaves in great numbers on frosty mornings, must not be thought to indicate that low temperatures cause abscission. Fitting found that *Geranium pyrenaicum* sheds its petals in a much shorter time (2.5 minutes) only when the temperature is raised to over 40° C. Lower temperatures, but yet as high as 33° to 34° were necessary, for certain other species, and in all cases the rapidity was greatest in a saturated atmosphere. Some species have their reaction time reduced from 25 seconds to 60 seconds (*Linum*, *Verbascum*, etc.). Hannig also found that temperatures higher than the normal laboratory ones caused a more abundant shedding of flowers and that sudden change was more effective than gradual. On the other hand, a lowering of temperatures inhibited it. That the higher, more effective temperatures increased the rate of abscission, and even cause them, as Wiesner (35) has suggested in the case of inner leaves, which may become over-heated does not militate against his explanation of abscission in consequence of frost, which may be procured, according to him, by the macerating (hydrolysing) effect of organic acids escaping from the frozen cells of the abscission layer or by the differences of tension produced at the limits of the dead leaf-stalk tissues and the still living and turgescent cells of the leaf-base. Entire killing of both leaf and abscission layer may be followed by the rotting away of the tissues, and thus ending in separation. High osmotic pressures, held by Wiesner and his pupils to be important in the case of ordinary abscission, have no place in frost defoliation.

THE EFFECT OF CHEMICAL AGENTS.

The air and soil of cities and in the neighbourhood of certain kinds of mills and factories is usually more or less contaminated, and, as a result, there is much detriment to the health of vegetation. Among the first symptoms to be noticed is the shedding of leaves, and this is doubtless a sensitive, and perhaps a very sensitive, indication of an abnormal condition. Harvey (36) found, for example, that one part of ethelene in 1,000,000 of air was sufficient to cause abscission of the cotyledons of the castor-oil plant (*Ricinus*), which is perhaps a more delicate reaction than would be observed in trees. It is significant, however, and we may expect to find similar behaviours in many plants. Even the small amount of illuminating gas found in the ordinary air of the laboratory was sufficient, according to Fitting, to produce abnormally quick shedding of petals, this result following dosage with carbon dioxide, tobacco smoke, chloroform, ether, and other agents. Brown and Escombe (40) found that other organs are similarly affected by disturbance of nutritive relations. Hannig got similar results, except in the case of carbon dioxide. 0.00002 vol. per cent. of illuminating gas caused the abscission of flowers (*Mirabilis*, etc.). A high concentration did not cause this directly up to 14 hours exposure, but indirectly after removal from the gas. Carbon dioxide, in concentrations up to 10 per cent., produced no effect, in accord with experiments of Demoussy (1903, 1904, see Hannig). On the other hand, leaves are shed if kept in air free of carbon dioxide (Loewi). It is evident that more work on this point, as indeed on all others, would be welcome.

Light. Light is the source of energy for green plants, so that much disturbance of this relation would be expected, indirectly at least, to lead to abnormal behaviours. It would be expected that changes in light intensity would have less effect on floral parts than on green parts, but Hannig and Fitting came to different results. Wiesner (39) believes that leaf abscission occurs in early summer in the leaves less favourably exposed to light because of the reduction of the absolute available light supply. I may observe that this kind of leaf-fall, as regards the time of occurrence, takes places whether shade is present or not. I have seen it on young plants of *Negundo*, which were completely illuminated, in which it seems more in accord with the appearances to recall Dingler's paper, earlier cited. Leaves shaded by the outermore foliage nevertheless do become yellow and fall (*Vitis*, *Ampelopsis*, *Euonymus*, etc.), and the earliest leaves in the White Birch in the autumn are those on the inner branches, irrespective of their age. In the climate of Quebec the question of high temperature is probably not important, and in such cases it seems quite proper to explain this, in the absence of more exact experimental observation, as due to the reduction of light.

The Time Required for the Act of Separation Proper.

By this is meant the time occupied by the process of separation itself to the exclusion of the period required to institute it (latent period). It would seem on general grounds that when cell division is involved, the process would require more time than otherwise. In some organs (petals) in which no cell-division occurs, the evidence (Fitting) shows that it may be quite brief, less than 30 seconds indeed, but we cannot say in any case exactly what it is.

There can be no doubt, furthermore, that the age of an organ has some influence. In the small cotton boll (8 mm. diam.) no evidence of separation (following injury) can be seen at the end of 16 hours, but at 20 hours the process is practically complete, as shown by the ease of removal of the peduncle. In larger ones cell-divisions in the separation layer can be seen for a day previous. However, the act of cell-division is not necessarily a precursor of separation, since in the young bolls above mentioned no cell divisions are to be seen at the moment of separation of the cells concerned, there being only a slight elongation of them, accompanied by a chemical alteration of the cell walls, causing the loosening. The essential phase of the process of abscission may, even in older as well as younger cotton bolls, be of much shorter duration than above indicated, less, namely, than four hours.

With reference to petals, Fitting found that in the dark, at temperatures of 31°-32°, they are shed earlier than normally, and the older the more quickly. On the other hand, petals of younger flowers were found by Fitting to be less sensitive than older, an apparent reversal of things which may be regarded as a "phenomenon of interference," between increasing adaptability and shortening of reaction time.[13] In petals, however, there is no development of mechanical elements, such as quickly appear in many leaves, to increase the amount of preparation before separation may become effective. Early in the season I have observed that abscission (in a moist chamber) will overtake older leaves frequently more rapidly than younger. The slowness of separation in indurated organs may simply mean interference by tissues or mechanical elements in which separation takes place only passively or not at all, as, *e.g.*, in the non-living or moribund pith in older cotton peduncles.

THE MECHANISMS OF ABSCISSION.

By "mechanism" is meant that histological behaviour resulting in the separation of one organ, or a part of it, from another organ or part. To the best of our present understanding it may be purely mechanical, either by a break (a) passing directly across the tissue irrespective of the position of the cell walls (rhexolysis, according to Correns 1, 372, *e.g., Dicranum scoparium*), or (b) passing along the middle lamella, causing separation of entire cells (schizolysis, Correns). In the latter alternative the separation is believed by some to result from a marked increase in turgor, the pressures causing the cells to become spherical and thus reducing their contact surfaces to nearly nil (Loewi, Fitting, Hannig). Or it may be a result of chemical alteration (a) of a part or (b) of the whole of the cell wall. The middle lamella may be dissolved, in this way loosening the secondary walls from each other; or the whole or part of the secondary membrane may be altered (Tison). Such chemical alteration may or may not be preceded by cell-division in the cells directly involved. Even in species in which this usually takes place, it may be omitted (Tison, Loewi) either entirely or in a part of the separation layer, as I have myself observed. When cell-division does occur, it is an expression of a resumption of growth (secondary meristem of previous authors), but as cell growth obviously does not necessarily lead to cell-division, this may be absent. The amount of growth may vary with external conditions, and it is usually much more marked under water or when high relative humidity prevails, and may lead to callus hypertrophy (Kuster, 40, p. 289). And in species where growth is usually omitted (*e.g.*, *Ampelopsis*, *Impatiens*) cell-division accompanying separation is still occasionally observable.

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[13] The character of the behaviour of petals under various stimulants has led Fitting to insist on a conception of abscission as an active separation of an entirely living organ in response to stimulation, quite analogous to movements, etc. He proposes the term "chorism" for this phenomenon.

Rhexolysis, while frequent in the mosses, is, so far as I know, generally quite rare, and its precise nature and the causes leading up to it need investigation. Tison believes it to occur in *Aristolochia Sipho* (leaf), but Loewi questions the accuracy of Tison's observations, basing his criticism on the similarity of Tison's description and drawings to appearances seen by him (*Laurus*, etc.), and leading to separation by the joint action of chemical alteration in the cell-wall and turgor. In view of my own work, Loewi's criticism is justified.

An apparently true case of rhexolysis, however, occurs in the style of *Gossypium*. Several minute transverse fissures appear at different levels somewhat above the apex of the ovary. These deepen and gape. Microscopically, they are seen to pass transversely through the tissues without relation to the position of the cell-walls, and without any evidence of separation of entire cells. The protoplasts, with their inclusions, are found *in situ* and the protoplasm torn through. Experiments indicate that external mechanical relations (pull or pressure of the staminal tube) are not factors. The fissures are not to be discovered before the latter half of the second day of anthesis.

Schizolysis is, on the other hand, general, but presents widely divergent appearances. The simplest cases (primary meristem) are those in which, by the solution of the primary membrane (middle lamella), the involved cells—usually occupying an ill-defined and irregular zone—can fall apart. Loewi, assigning to alteration of the membranes a very minor rôle, believes that separation, as exemplified in *Ampelopsis*, is accomplished chiefly by turgor increase, the greater surface curvatures reducing the contact areas and so setting the cells free. Kubart ascribes to chemical alteration a larger share in the process, still attributing, however, the chief place to turgor, *e.g.*, *Syringa*. Fitting excludes such alteration in the case of petals studied by him and sees, in a general sudden increase in volume of the cells, the active cause. I find in *Ampelopsis* and in *Impatiens* positive evidence against Loewi's view of the matter, separation not being found to involve any change in the shape of the cells, while evidence of chemical alteration, involving both primary and secondary membranes, has been clearly seen. Similarly, abscission of the corolla in *Gossypium* is without doubt accompanied by a decrease in turgor, being otherwise similar in operation to *Ampelopsis* (leaf, tendril, internode). But in this form the primary membrane dissolves first, and this is not preceded, at any rate to an appreciable extent, by alteration of the secondary membrane. Hannig's explanation of the process in *Salvia*, etc., and Kubart's in part of that in *Nicotiana* accord with my own, the latter finding in the organic acid released from the cells involved the agent of dissolution.

Different are, *e.g.*, *Lonicera*, *Syringa*, *Hydrangea*, and a number of others, chiefly, however, in that the secondary membranes are also attached, but more vigorously, and showing marked and measureable swelling. The collenchyma behaves peculiarly—the thickened walls resisting attack and lying free in the mucilaginous matrix. Aside from the last mentioned observation[14] Tison recognizes, in essence, this type of abscission. Kubart would designate it as "maceration."

Finally, abscission may be accompanied by growth, usually longitudinal, but, as regards the axis of the organ, may be more or less oblique. The growth (under special conditions very limited in amount) may or may not be accompanied by cell divisions, the occurrence of which has impelled earlier observers to regard the separation tissue as a secondary meristem. Before growth sets in, however, the cell walls are altered chemically (but only slightly) often in a restricted transverse zone about the cell, and the elongation of the wall takes place here (Loewi). But this chemical alteration may not be so restricted, but may rather be very general, as in the collenchymatic region of the leaf of *Populus* and of *Euonymus*, producing a condition directly comparable with that in the leaf of *Lonicera*, above cited, so that we may agree with Loewi in saying that there is no sharp line of demarkation to be drawn between these processes, the one being supplanted by the other even in the same organ. Thus, in *Gossypium* (the flower-peduncle), normally one to three divisions occur, previous to separation, but they may be quite absent in the peripheral tissues; and when rapid abscission follows a suitable stimulus, none at all are to be observed.

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[14] Hannig (12, p. 428) appears not to have observed this peculiar behaviour, and no one else, so far as I can determine, has done so.

The cells of the abscission layer may separate from their secondary walls at their distal extremities, and, in addition, the outer daughter cells may separate also from each other, one clinging to the distal rejected wall, but from which it is usually free, and one (or more) remaining permanently incorporated with the proximal wall. The separation in younger or thin-walled tissues may follow the plane of the middle lamella, but more frequently it occurs between a very thin innermost membrane (*i.e.*, that which immediately surrounds the lumen) and the earlier formed secondary membranes; or this membrane may have been laid down anew, during growth, against, but not incorporated with, the earlier formed secondary membranes. The evidence favours the former alternative; but this I cannot at present decide.

The crux of the problem of abscission lies in the manner of separation. It is conceivable that the mere increase of turgor is sufficient to cause separation along the place of the middle lamella. The smaller the cells, the more efficient can the energy at the disposal of the cell be applied; and small cells are found to characterize the abscission layer in many cases. Fitting favours this view in the light of the rapidity of reaction which, he believes, allows too short a time for swelling of the membranes, and because he could not see any such change in them. Renewed growth in these and increased turgor he regards as the responsible factors. (Fitting 21, p. 244-5). Strasburger (41), Tison (except in cases of rhexolysis) Lee (42) and others have taken a quite different position, seeing in the chemical alteration of the membranes a factor of primary importance. Tison calls the product of this change a pecto-cellulosic mucilage. The membrane lining the cell lumen does not take part in this. Growth contributes a relatively small part to the process. Hannig, too, takes the same position, except in the case of the peduncle of *Mirabilis*, in which occurs what he considers to be an undescribed method—a lysigenous one, involving the total destruction of the membranes. The appearances seen by him could, I believe, be reconciled with a method already known. This will, however, be discussed elsewhere.

Between these extreme views lie those of Wiesner, Kubart and Loewi, who, without denying a rôle to chemical alteration (by the excretion of organic acids, or perhaps enzymes), see in turgor changes the more important factor. They believe, indeed, that in some instances chemical change is absent.

The study of about 30 odd species leads me to the conclusion that chemical change is always present to some extent whether growth and turgor changes intervene or not. I found that under the influence of a hydrolysing agent (5% KOH) the walls of the abscission cells break down more readily than those of the neighbouring tissues above and below (*Cheiranthus*), and may be so treated as to stimulate advanced autolysis, both in the swollen condition of their walls and in their behaviour toward stains.

Concerning turgor effects it may be said that in such forms as *Ampelopsis* and *Impatiens*, which present ideal material for study, the abscission cells show a no higher osmotic equivalent at the time of abscission (of floral parts, peduncles, leaves) than others. In the case of the axis, the cells of the cortex and epidermis are pulled apart, apparently by elongation of the central tissues, since in partially wilted peduncles the faces of the abscission-wound remain juxtaposed, although abscission actually takes place.

Before, during or after abscission, secondary changes in neighbouring tissues take place. They consist of suberization, sclerification and lignification in various degrees, and all are either extensions of periderm or are of the nature of wound responses. This phase of the subject, beyond this very general statement, lies beyond the present purpose. Numerous details have been worked out by Tison and by Lee. It is, however, pertinent to indicate that, on the abscission of decurrent peduncles in *Gossypium* there may follow an extensive sacrifice of tissues, including all the living element of the stem, resulting in the formation of a wound-cavity of sometimes large extent, and not unlike gum pockets in appearance. Some of these phenomena recall the abnormal behaviours seen by Loewi, which, however, may readily occur in other species* (Ash, Poplar, etc.) under special conditions.

CITATIONS.

1. Correns, C. Vermehrung der Laubmoose. Jena. 1899.
2. Tison, A. Recherches sur la chute des feuilles chez les Dicotylédones. Mém. soc. Linn. Normandie. 20: 125. 1900.

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* At going to press, a paper by Gortner and Harris (Am. Jour. Bot. 1: 48-50, Jan., 1914) on "An Axial Abscission of Impatiens Sultani as a result of traumatic stimuli" comes to hand. They leave undecided the question of the method of abscission.

3. Lœwi, E. Blattablœsung und verwandte Erscheinungen. Proc. Vienna Acad. Math-nat. Class I. 166: 983. 1907.
4. Ramann, E. Die Wanderung der Mineralstoffe beim herbstlichen Absterben der Blætter. Landw. Versuchsstat. 76: 157. 1912.
5. Combes, R. Les Opinions actuelles sur les phenoménes physiologiques qui accompagnent la chute des feuilles. Rev. Gen. Bot. 23: 129. 1911.
6. Goebel, K. Pflanzenbiologische Schilderungen. Marburg, 1899.
7. Lloyd, F. E. Vivipary in Podocarpus. Torreya, 2: 113. 1902.
8. Lloyd, F. E. Guayule. Carn. Inst. Wash. Publ. 139, 1911.
9. Cook, O. F. The Culture of the Central American Rubber Tree. Bull. 49, Bur. Pl. Ind., U. S. Dept. Agr. 1903.
10. v. Hœhnel, F. R. Ueber den Ablœsungsvorgang der Zweige, u. s. w. Mitth. forstl. Vers. Oest. 1: 255. 1878.
11. v. Hœhnel, F. R. Weitere Untersuchungen ueber den Ablosungsvorgang u. s. w. *ibid.* 2: 247. 1879.
12. Hannig, E. Untersuchungen ueber das Abstossen von Blueten u. s. w. Zeitschr. f. Bot. 5: 417. 1913.
13. Wylie, R. B. The Morphology of Elodea Canadensis. Bot. Gaz. 37: 1. 1904.
14. Svedelius, Nils. On the life history of Enalus acoroides. Ann. Roy. Bot. Garden. 2: 267. 1904.
15. Balls, W. L. Cotton investigations in 1909 and 1910. Cairo Sci. Jour. 5: 221. 1911.
16. Reed, H. S., and Smoot, I. The mechanism of seed-dispersal in *Polygonum virginianum.* Bull. Torr. Bot. Club. 33: 377. 1906.
17. Yapp, R. H. Fruit dispersal in *Adenostemma viscosum.* Ann. Bot. 20: 311. 1906.
18. Atkinson, G. F. Alabama Agric. Exp. Sta. Bull. 41.
19. Kubart, B. Die organische Ablœsung der Korollen nebst Bemerkungen ueber die Mohlsche Trennungschicht. Sitz. Ak. Wiss. Wein. Math.-nat. Kl. 115: 1491. 1906.
20. Cook, O F. Bur. Plant Indust., U. S. Dept. Agric. Bull's 198 and 222; Circ. 109.
21. Fitting, H. Untersuchungen ueber die vorzeitige Entblætterung von Blueten. Jahr. f. Wiss. Bot. 49: 187. 1911.
22. Cannon, W. A. The effects of high relative humidity on plants. Torreya 6: 2-25. 1906.
23. Pool, R. J. Some effects of drought upon vegetation. Science. n. s. 35: 822. Dec. 5, 1913.

24. Klebs, Georg. Ueber die periodischen Erscheinungen tropischer Pfanzen. Biol. Centralbl. 32: 257-285. 20 May, 1912.
25. Volkens, G. Laubfall und Lauberneuerung in den Tropen. Berlin, 1912.
26. Flammarion. Bul. mens. off. Paris, 1907.
27. Dingler, H. Versuchen und gedanken zum Herbstlichen Laubfall. Ber. d. Bot. Gesellsch. 23: 463. 1905.
28. Lloyd, F. E. The artificial induction of leaf-formation in the ocotillo. Torreya. 5: 175-179. Oct., 1905.
29. Lloyd, F. E. Leaf water and stomatal movement in *Gossypium*, and a method of direct visual observation of stomata *in situ*. Bull. Torr. Bot. Club. 40: 126.- Jan., 1913.
30. Livingston, B. E., and Brown, W. H. Relation of the daily march of transpiration to the variations in the water content of foliage leaves. Bot. Gaz. 53: 309. 1912.
31. Balls, W. L. See 15, above.
32. Mohl, H. Ueber den Ablœsungsprozess saftiger Pflanzenorgane. Bot. Zeit. 18: 273. 1860.
33. Darwin Ch. The different forms of flowers on plants of the same species. London, 1877.
34. Bull. 114, Bur. Ent., U. S. Dept. Agric.
35. Wiesner, J. Ueber Hitzelaufall. Ber. d. Bot. Gesellsch. 22: 501. 1904.
36. Harvey, E. M. The castor-bean plant and laboratory air. Bot. Gaz. 56: 439. Nov., 1913.
37. Brown, H. T., and Escombe, F. The influence of varying amounts of carbon dioxide in the air on the photosynthetic process of leaves and the mode of growth of plants. Proc. R. Soc. London. 70: 397. 1902
38. Demoussy, E. Sur la végétation dans les atmosphères riches en acide carbonique. Compt. rend. acad. sc. Paris. 136: 325. 1903; 139: 883. 1904.
39. Wiesner, J. Ueber Laubfall infolge Sinkens des absoluten Licht genusses. (Sommerlaubfall). Ber. d. Bot. Gazell. 22: 64. 1904.
40. Kuster, E. Pathologische Pflanzenanatomie. Jena, 1903.
41. Strasburger, E. Das Botanische Praktikum. 349. 1913.
42. Lee, E. The morphology of leaf fall. Ann. Bot. 25: 51. 1906

DEPARTMENT OF BOTANY,

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GALL MIDGES AS FOREST INSECTS.

By E. P. FELT, Albany, N.Y.

The minute gall midges or Itonididae have been practically ignored by the forester and, taken as a group, little is known of their economic importance under average woodland conditions. The larger, frequently abundant deformations produced by the gall-making wasps, Cynipidae, and the sawflies, Tenthredinidae, are relatively much better known, though it is probable that they are of less economic importance.

Numerous gall midges, referable to the Lestreminae and Heteropezinae, live as larvae in decaying woody tissues and materially hasten the process of disintegration. Species of *Miastor* and *Oligarces* inhabit the inner bark of various trees in incipient stages of decay, while some species of *Monardia*, such as *M. lignivora* Felt have been reared from the fungous affected heart-wood of pine and undoubtedly hasten decay. Some Epidosariae inhabit dead, mostly dry, woody tissues.

All of the foregoing species are of less importance than the gall-making forms infesting living trees. The deformations of the latter may be conveniently classified according to the part affected.

Seed of fruit-inhabiting midges, such as *Dasyneura canadensis* Felt, may destroy a considerable proportion of seed in spruce cones. The same is true of *Oligotrophus betulae* Winn. and birch seed, while *Itonida catalpae* Comst. infests Catalpa pods and is a pest of some importance. Whitish, flower-shaped, fungoid galls, probably a bud and possibly a fruit deformation, are numerous in some parts of the South on Bald Cypress, *Taxodium distichum*, and are caused by *Itonida anthici* Felt. The extent to which fruit infestation may go in this group is shown by the rearing of seven species from the fruit of various wild cherries.

Bud galls are produced by many species and usually mean the death of the affected part, or at least a resultant deformation. The Catalpa midge, mentioned above, not only infests the seed pods but destroys the greenish tips and produces stunted, comparatively worthless trees. *Phytophaga ulmi* Beutm. and *Dasyneura ulmea* Felt infest lateral and terminal buds of elm sprouts and occur somewhat abundantly, though their injuries have not as yet been considered of much practical importance. The Box Elder in the West suffers from the attack of two gall midges, namely, *Cecidomyia negundinis* Gill., a bud-inhabiting form, and *Contarinia negundifolia* Felt, a species which attacks the leaves while still within the bud. *Contarinia coloradensis* Felt infests and destroys the terminal buds of *Pinus scopulorum* in Colorado and occasionally appears to be somewhat abundant. Spruce buds are destroyed in Canada and probably in the Adirondacks by *Phytophaga isugae* Felt and the terminal ones in part by *Rhabdophaga swanei* n. sp.

RHABDOPHAGA SWAINEI n. sp.

The midges described below were reared by Mr. J. M. Swaine, Ottawa, Canada, the latter part of May, 1914, from spruce bud galls. This species apparently confines its attack to the terminal bud. It is easily differentiated from other known species of *Rhabdophaga* by the characters given below.

Gall. The enlarged bud has a length of about 7 mm. and a diameter of 4 mm., the lateral scales being somewhat reflexed and the apical portion of the gall loose and open. It contains a central, oval cell about 1.5 mm. long.

Male.—Length 2.25 mm. Antennae probably nearly as long as the body, dark reddish brown, presumably with 14, and possibly with more, segments, the fifth with a stem about ½ the length of the basal enlargement, which latter has a length 2½ times its diameter. Palpi: first segment ovoid, the second ½ longer than the first, moderately stout, the third ½ longer than the second, more slender, the fourth ⅓ longer than the third, slender. Mesonotum shining dark brown, the submedian lines sparsely gray-haired. Scutellum, postscutellum and abdomen dark brown, the latter sparsely haired. Genitalia reddish brown. Halteres, coxae and femora basally reddish brown, the distal portion of femora, tibiae and tarsi mostly dark brown; claws moderately stout, curved, minutely unidentate, the pulvilli ½ longer than the claws. Genitalia: basal clasp segment moderately stout; terminal clasp segment rather short, swollen near the middle; dorsal plate deeply and triangularly emarginate, the lobes divergent, the outer margin tapering roundly to a narrowly rounded setose apex; ventral plate rather long, broad, deeply and roundly emarginate, the lobes short, stout, sparsely setose. Harpes broad, broadly rounded and thickly setose apically; style short, tapering, narrowly rounded distally.

Female.—Length 2.25 mm. Antennae probably extending to the second abdominal segment, sparsely haired, light brown. Mesonotum dull dark brown, the submedian lines sparsely fuscous haired. Scutellum dark brown, postscutellum a variable yellowish and dark brown. Abdomen dark brown, the margins and ovipositor reddish orange, the venter reddish brown. Halteres yellowish orange. Coxae yellowish brown; femora and tibiae dark yellowish brown, the tarsi darker, almost black. Ovipositor moderately stout, as long as the body; terminal lobes broad, the length thrice the width and thickly setose. Other characters practically as in the male. Type Cecid a2520.

LEAF GALLS. The primary infestation, as we have shown elsewhere, frequently begins in the bud. Deformations belonging in this class are not very important, though *Thecodiplosis liriodendri* O. S. is responsible for serious disfiguration, and probably some weakening of tulip leaves, particularly in the latitude of North Carolina. The recently established box leaf miner, *Monarthropalpus buxi* Lab. of Europe, appears to be a serious pest of the highly prized ornamental Box. The young leaves of the Black Locust, *Robinia*, may be seriously deformed by the larvae of *Dasyneura pseudacaciae* Fitch, or the margins rolled by those of *Obolodiplosis robiniae* Hald. *Contarinia canadensis* Felt, the probable producer of the midrib gall on ash, is so abundant locally in the Hudson valley as to seriously affect the foliage of saplings. The extent to which leaf infestation may go is shown by the fact that some 22 species of gall midges are known to infest the leaves of hickory and about 20 those of oak. Most of these, as well as numerous other leaf-inhabiting forms, are of comparatively little importance.

STEM GALLS. Irregular, subcortical galls are produced in living tissues by species of *Rhabdophaga* and *Lasioptera*, the former being confined mostly to willow. The European *Rhabdophaga salicis* Schr. has become established in some localities where basket willows are grown and causes considerable loss by ruining the shoots for both basket work and the binding of bundles of nursery trees. Willow twigs are attacked by 21 American species of gall midges. *Lasioptera querciperda* Felt lives in the subcortical tissues of white oak twigs, producing gnarly areas and, presumably, defects in the wood. Several species of *Itonida*, *I. resinicola* O. S. and *I. resinicoloides* Wlms. attack the inner bark of young pines, and in some instances considerable pitch exudes and rather serious injury may result in the case of individual trees. *Itonida inopis* O. S. is a subcortical form, the larvae producing a swollen, gouty condition of the twigs and a marked lowering in the vigor of badly infested trees.

Root galls are known in only a very few cases, probably because of the difficulty of discovering them, and, so far as forest trees are concerned, none of importance have been recorded.

A general survey of the gall midges known to infest forest trees, shows that the hickories, the oaks and the willows, and to a less extent the poplars, all representing genera with a number of closely allied species, are subject to attack by numerous gall midges, indicating an extremely close relation between the infested plant and the insect dependent thereupon. The bud-inhabiting gall midges are potentially the most destructive, and, owing to the known prolificacy of certain gall midges, it is to be expected that injuries by species referable to this group will become more, rather than less, apparent with the advance of time.

EXCURSIONS.

The second excursion of the season was held on the afternoon of Saturday, May 9th, the locality visited being the north shore of the Ottawa River above the Chaudiere Falls. The rock formations were rich in fossils; the trees and general vegetation, at this season, were assuming their spring verdure, and the pools by the banks of the river contained a variety of forms of life. A large attendance of members was present and much interesting material was examined and collected. The President, Mr. Arthur Gibson, was in charge of the party. At the close of the outing addresses were delivered at the side of a grassy knoll close to the river, and the first leader called upon to speak was Mr. Halkett, of the zoological branch. Specimens of two kinds of small crustaceans—one an amphipod (*Gammarus*) and the other an isopod (*Asellus aquaticus*), as well as several kinds of fresh water pulmonate gastropod mollusks were passed around and points explained regarding their life-habits.

Miss Fyles spoke of the plants which had been observed or collected. Several specimens of *Geaster hygrometricus* were found. It was pointed out that the Geasters were distinguished from the puffballs by the outer coat, which breaks and spreads out in the form of a star, whence the name Earth-star. This odd and interesting fungus is very sensitive of moisture, spreading out its star-like coat in wet weather and folding in its points when the atmosphere is dry. Miss Fyles also gave an interesting account of the life-history of the Horse-tails (*Equisetum* spp.)and of many other plants which were handed to her to name.

A very interesting account of the herbs used by the Iroquois medicine men was given by Mr. Waugh, a leader of the archæological branch, the substance of which he has since supplied in manuscript notes, which, given in his own words, are as follows:—

"A large number of animal and vegetable materials are used in the Iroquois medicines. Although many of the herbal or vegetable preparations are most effective from a therapeutic standpoint, a great deal of reliance is placed in sympathetic magic or the idea that like cures like. For instance, bloodroot is used to purify the blood because the juice is red. This idea is at the bottom of a large percentage of Iroquois remedies. A decoction of stoneroot is given to children in the belief that it will make them hardy. Quite a number of effective laxatives and emetics are known where barks are used. These are scraped up or down according to the action required. Among the laxatives are mandrake root, also a decoction of butternut bark. A hunting medicine is made of the early leaves of *Prenanthes* or lion's foot, from a fancied resemblance of these to the heads of a buck and a doe. A decoction is made and the rifle-barrel washed with it inside and out. The small spherical bulb found attached to the dwarf ginseng is crushed and tied to fishing tackle to give luck in fishing. A selling medicine is obtained by chewing a small wood anemone (*Anemone quinquefolia*) and rubbing the juice on the hands when about to offer anything for sale. The person to whom the articles are offered will not be able to resist buying. A medicine to give speed in running is derived from the toad rush (*Juncus bufonius*). A decoction is made and the body and limbs washed with it, the idea being that, as the plant grows beside the runner's pathway, it will assist him in running. Love medicines are very common. Every native medical practitioner has several. These are also usually based on sympathetic magic. For instance, two leaves of *Aster cordifolia*, which lean one upon the other, are taken, and a decoction made and rubbed upon the face and hands. A remedy for snake-bite is obtained by finding a root of the white ash which sticks up like a snake's head. This must be kicked off with the foot. A decoction is made of this and applied to the bite. Among the most important medicines are a couple of secret preparations belonging to medical societies. These are found to consist largely of a number of fanciful or mythical ingredients. These medicines are considered the most effective of any and their administration is connected with a series of ceremonies."

The next speaker, Dr. Williams, spoke of the birds, observed, viz.—the herring gull, the spotted sandpiper, the ruffed grouse, the northern flicker, the American crow, and the tree swallow.

This last-mentioned useful little bird is very common in the vicinity of Ottawa this spring, and it is to be hoped that some may take possession of the nesting boxes either at Rockcliffe or at the Experimental Farm.

In addition to the above, brief addresses were also delivered by the President and the Rev. Seymour Bullock.

A.H.

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THE PROBLEM OF BIRD ENCOURAGEMENT.

By W. E. Saunders, London, Ont.

The question is, *How* to increase the number of our birds. Hardly anyone doubts the statement that "More birds would be a benefit to mankind," and the popularity of the efforts being made in that direction speaks volumes for the state of public sentiment; but "*How*" are we to do it?

The people to whom such encouragement will mean the greatest financial return are the farmers, and not only have they the best opportunity of producing an increase in bird numbers, but all the expense called for is the rental of an acre or two of ground, and the labor of fencing and planting it with the proper trees, shrubs and vines. From such an outlay, the revenue returned should be a good one, and the results are liable to be better if the planting is of the most attractive character than if it is done in a haphazard manner.

In a general way, the principle may be stated that most of our insectivorous birds like a little fruit at times, and the best way to provide this for them is to plant little shrubs bearing the native fruits in their little jungle, rather than to attract them to the orchard and there feed them with high-class grapes, English cherries, etc.

The size and location of such a bird reserve will vary according to the enthusiasm and ability of the owner. An acre or two would make a splendid jungle, and in southern Ontario would probably be used even by the quail, which is one of the most useful of all insect eaters.

In the bulletin on the chinch bug recently issued by the Division of Entomology, at Ottawa, the quail is given credit for being the only bird that is specially useful in fighting this particularly injurious insect. Those farmers near London, whose crops suffered so severely, in 1913, from this insect, would probably be willing to give serious consideration to the question of bird reserves, realizing that such reserves would have meant money in pocket if they had been established years ago.

The area selected for the jungle should be well fenced, preferably with heavy netting at the bottom. Dogs, and if possible, cats should be excluded, as well as rabbits. The experience of the western sheepmen who fenced a large section of land to exclude coyotes, should be remembered; after the fence was completed they found they had fenced some coyotes in.

A few clear spaces among the planting are desirable, but the bulk of the ground might be thoroughly covered to good advantage. Shrubs and vines of rapid growth should be introduced even if they are not so desirable for permanent use· most essential, however, is the planting of fruit-bearing trees and shrubs, which will be used as food by such species as desire it.

Almost every kind of tree has some features that are desirable from the standpoint of the birds; for instance, the foliage of basswood is subject to aphis, which makes it very attractive to warblers and other small insect eaters. As supply of insect food of some sort, however, is found on every tree and shrub, in these trees only those that are especially adapted in some way to the purpose of bird encouragement, are here recommended.

In the list should be a couple of hemlocks at good distances apart. These trees are the most attractive of all to the crossbills in winter, hemlock seeds being their favorite food. Six Manitoba maples are recommended because the fruit hangs all winter, and when the rare Evening Grosbeak visits us it is very fond of it. This tree varies a great deal in its seed producing qualities, and for that reason six are recommended, but only two ought to be left and those two should be selected for their seed bearing qualities. A few mountain ash trees will provide berries for the late fall and winter birds, while mulberries and the native shadbush are needed for summer fruits.

In an investigation by the U. S. Biological Survey, Washington, a very few years ago, it was found that the berry which was most widely esteemed by the birds was the elder; therefore it would be well to plant a number of these. Thorn bushes make excellent bird covers and the fruits are used by some birds in the autumn. The native Viburnums, with berries varying from white to black, are also used by the thrushes and other birds. The wild blackberry should be planted for the purpose of making a tangle, which the birds delight in, and as they have long been accustomed to it, it will be specially acceptable. The wild red raspberry is much frequented and desired by some birds. Currants, while not particularly desirable would doubtless add to the general attractiveness of the jungle. Then there should be climbers, particularly the two bitter sweets, the climbing bitter sweet and the annual one. But the best and most useful climber of all is the wild grape. Plant these beside a brush heap and they will soon cover it and make ideal protection for many of the seed eaters, and food for larger birds. Small willows are not only desirable as providers of insects, but also because of the ease with which they take root and grow.

There is no good reason why some ornamental shrubs should not be used, particularly on the sides facing the house and road. Spirea Van Houtte, (the Bridal Wreath) Lilacs, Philadelphus or Mock Orange, Exochorda, and others, could be used with advantage and beautiful effect, moreover, many of these are already popular with the birds we are trying to attract. And while some objection may be raised to them on the score of expense, yet that objection does not apply to lilacs, which sucker freely; so that one can obtain a hundred small plants by digging and dividing a single old one.

Consideration should be paid to the future appearance from the farm house; the tallest growing plants should be farthest away, the height graduating down, with only very dwarf things on the side next the house. This plan will give a much more extended view from the house, than if high vegetation is placed on the side next the house.

All these trees and shrubs should be planted not closer together than ten feet, unless enthusiasm and opportunity are unusual, and if so planted, it will be five to ten years before any require to be taken out. When they grow into one another, it would be well to remove some of them, as by that time the birds would have ample cover.

At first there will appear to be a great deal of unused space, and such might be planted to millet and buckwheat. This would of course apply only to the first season as after that it should be left so that the shrubs could have their own way.

Two weeds whose seeds are very much admired by winter birds are ragweed and pigweed. If a patch of these weeds is planted, it should be on the house side and not closer than twenty or thirty feet from the edge of the jungle, so as to prevent the weeds from spreading into the neighboring cultivated land. When the first year's growth has taken place there is little danger of the spreading of such weeds over what will then be uncultivated ground.

The above list contains most of the plants that are specially suitable for the purpose, but while endeavoring to procure as many of them as possible, the planter will of course use largely the shrubs that happen to be most available, employing also such wild perennials as golden rod, aster, etc.

Old stumps will prove an attractive addition to the reserve and will be an attraction to the chickadees in the nesting season. If these birds can be induced to locate there, they may be easily held for the whole year by a little feeding in winter, and no bird is more useful in the orchard than this species.

For the first few years there will be no place in this plot where robins can rest. This lack will seldom be very noticeable, as most farms have already some old trees in which they may nest, but, if there is absolutely no opportunity for them the need may be easily supplied, by a piece of 2 x 4 scantling driven into the ground, with two cross pieces near the top, forming a suitable nest foundation, the whole to be covered with a collection of dead vines, etc., leaving space for the birds to enter. If some wild cucumber is planted at the base of this, it will cover the post after a few weeks of growth.

A few nesting boxes stuck up on posts or on large trees would serve to attract bluebirds, tree swallows and house wrens, but care must be taken to keep down the English sparrows by means of trap and gun, or else these native species that nest in cavities will be unduly harassed and prevented from breeding.

It is well worth while to put up on a pole a house for the Purple Martin. If these birds can be induced to come, they will form a very important addition to the ranks of insect destroyers.

On May 24, 1913, I saw a little home-made Martin house on a pole in a farm yard about 25 miles north-west of London, and it had three or four pairs of Martins domesticated in it. What one farmer has accomplished, another may do.

Red squirrels should be persistently destroyed. These animals are second only to the domestic cat as bird exterminators, and will devour every available brood of nestlings unless they are prevented.

A path winding through the jungle would be no detriment and may often be a convenience. It should go near the trees, and as these will prevent any thick growth coming beneath them, wild flowers can be added to the collection when they are partly grown.

During the first year or two, the occasional use of the hoe around the newly introduced plants will hasten growth, but during the season of bird nesting, from May 1st to July 1st, too frequent presence on the reserve is not desirable until the birds have become thoroughly at home.

A plot of ground set apart for a bird reserve and treated as described above ought to begin to show practical results in the second year, and it will be surprising what a tremendous difference in bird numbers can be made by a little attention to their needs.

That this attention will give a substantial return in dollars and cents cannot be gainsaid, while for those fortunate country residents who already love the birds, and desire their presence, the results will be a constant joy.

Personal inquiries on this subject are invited by the writer.

MYOSURUS IN CANADA—I.

By EDWARD L. GREENE.

Throughout the whole of Eastern North America the genus *Myosurus* is very scantily and feebly represented, and that too, in as far as our knowledge goes by the single species, *M. minimus*, an old world plant and the type species of the genus; and this is so great a rarity here at the east as to have been observed hitherto in no more than two localities, east of the Ohio river. One of these stations is Belleville, in southeastern Ontario, the other Norfolk, in the extreme southeastern corner of Virginia. The two stations are about 500 hundred miles apart in linear distance. For none of the intervening states of New York, Pennsylvania, Maryland, or for any of those of New England or the Maritime Provinces of Canada, is there any record of Myosurus; and for further demonstration of the complete isolation of the plant at Belleville, let it be taken note of that from that point southwestward to south-central Illinois, where it occurs again, the distance is some 750 miles. Then measuring the distance westward and within the Dominion, to where it occurs again in Assiniboia, we have 950, if not a round 1000 miles.

At the time when the plant was first detected at Belleville its isolation there would have appeared still more pronounced if the matter of its very sparing occurrence in North America had been taken into consideration; for in 1878, when Professor John Macoun brought forward specimens from there, the Virginian habitat was not yet known, and the nearest known stations for it eastward and southward were as very far away as Georgia, Tennessee, and Kentucky. At Norfolk, Virginia, it was not detected until 1893, or fifteen years later than Professor Macoun's obtaining it at Belleville.

Mr. F. V. Coville, the discoverer of the Norfolk habitat, remarked that the plant had the appearance of a recent arrival there; but in the case of the station in Ontario, Professor Macoun registers no supsicion that it is other than indigenous there. Indeed, he took it to be native, as we shall see later; and in this he may have submitted to the opinion of authors within the United States, not one of whom, in writing of *M. minimus* as occurring with us here, and there southwestward and far westward, expresses a doubt about its being native. Accepting this doctrine, there was, with the discoverer of the Ontario station, no occasion to question how the plant came there, however strangely isolated it was. But here I must reproduce his very interesting first notes about it in the first volume of the Catalogue of the Plants of Canada, P. 15.

"On ground subject to overflow and on limestone shingle at the ferry house opposite Belleville, Ontario; rocky pastures west of Albert College, Belleville, Ontario."

Here are given as many as three different kinds of environment for the plant as it was found growing in the vicinity of Belleville, now almost forty years since; and I know of no other more recent mention of Myosurus as being there. Results of a diligent, renewed investigation of the locality after so long a lapse of time would be very interesting, whatever they might be. One thing, however, which the language of Professor Macoun suggests to me is the possibility of there being in the Belleville neighborhood more than one species of the genus. I refer to the different kinds of environment, in each of which he found the plant growing. The expression, "ground subject to overflow", though not very definite, implies the prevalence of a good degree of moisture; but whether some stretch of low plain be meant where a temporary pool is formed after every good rain, or whether it were a stream bank where waters rise and fall at intervals—all these are uncertainties. But the European plant is said to grow there nowhere but in low, moist lands. This is not, however, true of all the several Myosurus species native to America in the Great Basin and on the Pacific slope of the continent; and when "limestone shingle" is named as another environment of the Belleville Myosurus, the mind of the widely travelled student of these plants is reminded of the habitat of certain far western members of the genus. So also does the Belleville rocky pasture locality; for that should mean on the rocks themselves, either in their seams and crevices or on top of them, where there is little depth of earth, and some considerable degree of aridity; for as far north as eastern Ontario, all, except the rocks of a pasture, is occupied by perennial grasses, into the sod of which no Myosurus or other annual finds a foothold. In a word, the whole story of the Ontario locality for these plants points to the derivation of this colony from the far westward. Moreover, between the northwestern shore of Lake Ontario and those far-away Myosurus stations of the Southern States, there is practically no commercial traffic at all; whereas, by means of the Canadian Pacific Railway System, there is a very direct and constant inter-communication between all British Columbia and even eastern Ontario.

Long after his having discovered that Belleville colony of these plants, Professor Macoun found Myosurus on Vancouver Island, and I find his remark on this also very interesting It occurs in his supplement to the volume already quoted, page 479. Listing it there, still under the name *Myosurus minimus*, he says: "It is extremely probable that the British Columbia form is a distinct species." This is a plain intimation that while still regarding the eastern plant as the real original *M. minimus* and native there, he saw discrepancies between the two, and suspected the Vancouver Island plant to be really new and nameless. Into these matters the present writer intends making further and critical research, the results of which may be presented later.

THE GENUS *ANTENNARIA* IN GREENLAND.

BY MORTEN P. PORSILD.

The Antennarias of Greenland have for a long time—by Joh. Lange and later authors—been determined as (1) *A. alpina* (L.) Gaertn., (2) *A. alpina* var. *glabrata* J. Vahl, (3) *A. dioica* var. *hyperborea* Don, to which L. K. Rosenvinge has added (4) *A. alpina* var. *intermedia* Rosenv. A closer study of the forms and their occurrence in the field has shown, that the last mentioned three are hereditary constant and hence probably distinct species, the hitherto called *A. dioica* var. *hyperborea* from Greenland being in some details different from all specimens seen by me of *A. dioica* from Europe or Asia. Having, however, a very restricted access to literature and a still lesser one to collections, I am at a loss to give full particulars concerning the synonymy and distribution of some of the species, and allow me to invite the attention of American botanists to them, as most likely one or another of the species here considered as new may also occur in the eastern parts of arctic or subarctic America.

A more detailed study of the species together with full diagnoses and figures will soon appear in the "Arbejder fra den Danske Arktiske Station paa Disko."

SYNONYMY AND DISTRIBUTION OF THE GREENLAND SPECIES OF ANTENNARIA.

1. ANTENNARIA ALPINA (L.) GAERTN.

West-Greenland: common to about Disco Bay, hence becoming scarcer and confined to well exposed lowland stations, collected however at Cape York, 76° 07' and in Hayes Sound, on Grinnell Land, 79° 04'.

East-Greenland: from the south to about 72°, common in the better investigated places, but *not found in North-East Greenland.*

America: Arctic Archipelago up to Melville Island, arctic, subarctic and alpine continental North America, Rocky Mountains, American and Asiatic coasts of Behring Strait, arctic and subarctic East-Siberia to Lena River, whence it seems to be replaced by *A. carpathica*, Altai, reaching the coast again in arctic Russia, Kolgujew, arctic and alpine North-Europe, Iceland, *wanting* on Jan Mayen, Spitsbergen, Nova Zembla, Franz Josef Land and New Siberian Islands; in other words, an arctic alpine, nearly circumpolar species, however, not reaching the northernmost limits for plant-growth.

A. alpina var. *Frieseana* Trautvetter: Act. Hort. Petropol. VI. 1879, page 24. *A. monocephala* (DC.) Ledeb. Fl. Ross. II, page 611. *A. alpina* var *monocephala* (DC.) Torr. & Gray: Fl. of North America II, page 430.

In East-Siberia the commonest form, but connected with the main form by numerous transitions; also found in Greenland and America.

2. Antennaria glabrata (J. Vahl) Porsild n. sp. Syn.: *A. alpina* var. *glabrata* J. Vahl: Flora Danica tab. 2786, fig. 4. Joh. Lange: Conspectus Florae Groenlandicae, Meddelelser om Grönland III. 1880, page 100.

West-Greenland: between 64° and 72° 20'.
East-Greenland: between 66° and 72°.

Not rare on Disco Island, although much rarer than the preceding. Probably often overlooked, although it is very conspicuous. Not found in the southernmost parts of Greenland by collectors knowing the plant very well (Vahl, Rosenvinge, Hartz, Kruuse).

3. Antennaria groenlandica Porsild nom. nov. Syn.: *A. dioica* var. *hyperborea* Lange l. c. but probably not *A. hyperborea* Don: Edinburgh Philosophical Journal, 1834, (a paper not accessible to me), more probably—*A. hyperborea* Fernald & Sornborger: Some recent additions to the Flora of Labrador, The Ottawa Naturalist, 1899, page 106.

West-Greenland: 60° and 67°, commonest in the South.
East-Greenland: twice collected, at 61° and 66°.
Labrador?

On Iceland neither is *A. groenlandica*, nor *A. dioica* nor any other of the nearest allies of this species found.

4. Antennaria intermedia (Rosenvinge) Porsild n. sp. Syn.: *A. alpina* var. *intermedia* L. K. Rosenvinge: Andet Tillæg til Gronlands Fonerogamer og Karsporeplanter.. Meddelelser om Grönland III. Forts. 3. 1892, page 698. *A. alpina* δ Th. Holm. Beiträge zur Flora Westgrönlands, Engler's Bot. Jahrb. 8, 1887, page 310.

West-Greenland: hitherto only found a few times between 61° 45' and 70° 05'. On South Disco, near Godhaven, several stations are known to me. The plant flowers here much later than do *A. alpina* and *A. glabrata* on the same spots, whence I suppose that it here is near its northern limit and should be searched for in more southerly latitudes.

	(1) *A. dioica* (L.) GAERTN. from Europe and Asia.	(2) *A. groenlandica* PORSILD	(3) *A. intermedia* (ROSENV.) PORSILD	(4) *A. alpina* (L.) GAERTN.	(5) *A. glabrata* (VAHL) PORSILD
Caudex	with rosulate clusters and with prostrate, apically upward bent stolons	=1.	=1	=1, the stolons are, however, relatively shorter	cespitose, stolons wanting, with densely aggregated clusters of rosulate leaves
Rosulated leaves	lanceolate - spathulate, ordinarily with small apiculus, 15-30 (-45) mm long, 5-9 mm broad	=1, but smaller and narrower, 10-24mm long, 2-5mm broad	=2	lanceolate - spathulate, often without apiculus, 10-20mm long, 2-4mm broad	narrow lanceolate, apiculus ordinarily distinct, 10-20 mm long, 1-3 mm broad
Tomentum of rosulate leaves	ordinarily only on the underside, in the var. ***hyperborea*** on both sides. Tomentum dense, but thin, snowy white, almost shining, reminding one of napless, worn out cloth.*	equally on both sides. Tomentum dense and thick, not snowy white, but with a faint gray-greenish tint reminding one of nappy, not worn cloth.	=2	varying much; nearly always densely tomentous on the underside, often on both. Sometimes the felt is with interstices, floccose, grayish white, not shining	ordinarily tomentum quite absent, with isolated rudimentary hairs, rarely with small isolated floccose tufts
Flowering stems	12-20 (-25) cm high tomentous	10-16 (-20) cm high tomentous	=2	5-12 (-18) cm high, tomentous	8-10 (-12) cm high, slender, without hairs
Inflorescence	cymose with 3-7 brevipedicellate heads, rarely corymbiform (var. *corymbifera* HARTM.	=1	subglobose, heads 8-12 small nearly sessile	=1, the var. *Frieseana* only with 1-3 heads	ordinarily one large head seldom two.
Length of flowering heads	10-12 mm	6-8 mm	4-6 mm	6-8 mm	8-12 mm

Involucral bracts	obtuse, entire or faintly crenulate, the scarious parts bright purple or white, the basal parts tomentous	=1	obtuse, entire or faintly crenulate the scarious parts dark greenish brown, basal parts tomentous	acute, irregularly lacerate the scarious parts with various tints of brown, European forms often redbrown, basal parts tomentous	acute, the scarious parts irregularly lacerate, dark greenish brown, basal parts green without tomentum
Flowers and propagation	dioicous, pistillate and staminate flowers, fertilization normal.	only with pistillate flowers, apogamic	=2	=2	=2
Pappus bristles of pistillate flowers	slender, 20-30 μ thick, rather faintly denticulate	somewhat coarser, 30-40μ thick, denticulate, teeth of upper parts faintly curved upwards	still coarser, 40-50μ, basal parts squarrosely denticulate, teeth of the upper parts larger, erecto-patent	coarse, 50-60μ, especially in the upper parts densely denticulate, teeth patent, up to 50μ long	=4

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*Through the courtesy of the Botanical Museum of Copenhagen, I have had dried specimens of *A. dioica* and its variety *hyperborea* from some 18 different parts of Europe and Asia for examination. The localities range from Kolgujew to Southern France, and from Scandinavia to Western Siberia. Besides, I have seen a good deal of *A. alpina* from various parts of the world, and all the material of the genus from Greenland, preserved in the named Museum.

All species of *Antennaria* in Greenland produce well developed fruits having the power of germination. As staminate flowers are totally wanting, the propagation of all species must be apogamic, as for a long time such has been known to be the case with *A. alpina*. The *A. glabrata* and *A. intermedia*, as they are growing near my home, are without doubt hereditary constant. They often form extended pure patches, the form of which depends on the circumstances of local wind or the outlet of melting water in the spring.

If my understanding of the species be right, *A. alpina* must be regarded as an old species that found its way to Greenland after the glacial period, probably over Smith Sound, where the crossing may have taken place during an epoch with milder climate than now rules in Greenland. *A. groenlandica*, however, belongs to the large contingent of American plants of South Greenland,[4] that cannot have immigrated by this way. *A. glabrata* and *A. intermedia* are undoubtedly young species, or perhaps species *in statu nascendi*, the former developed from *A. alpina*, the second from *A. groenlandica*.

We have thus in the Greenland species of *Antennaria* a new example of polymorphy in apogamic genera (cfr. *Alchimilla*, *Taraxacum*, *Hieracium*).

Disko, Greenland, Dec. 1913.

EXCURSIONS.

The third excursion of the season was held at Britannia, on the afternoon of Saturday, May 16th. The party walked to a wooded grove, and the time was mostly engaged in botanical observations. At the addresses leaders spoke of the plants, birds, insects, and batrachians observed or collected. and information along general lines of natural history was imparted.

The fourth excursion was held at Fairy Lake. This was on the afternoon of Saturday, May 23rd. After leaving the electric cars, the party walked for a distance, until this ideal spot, known as Fairy Lake, was reached. The excursion was of the nature of a saunter, and the usual addresses were purposely dispensed with, this leisurely walk homewards through the woods of the Beaver Meadow taking for this occasion their place.

The fifth excursion was held at Leamy's Lake, on the afternoon of Saturday, May 30th. Although there was only a party of nine, the occasion proved to be most enjoyable and profitable. Mr. Gibson, the President, drew attention to a carabid beetle devouring a tent caterpillar; a partridge's nest, containing a set of twelve eggs, was found, and the woods were profuse with flowers and ferns.

The sixth excursion was held at Ironsides, on Saturday afternoon, June 6th. The train left the Broad Street Station at 1.40 p.m., and, on arriving at the destination, the party walked along the railway track until reaching a woodland, where it dispersed its minor parties, according to the phase of nature each desired to study. Mr. Sladen gave his attention to bees and captured a goodly lot. A wood-chuck or ground-hog was seen by several persons, and as it remained all the time beside its burrow, a fine observation was had of it. At the short addresses, which were interrupted by the arrival of the homeward bound train, Mr. J. W. Gibson, whose new professional duties have called him to British Columbia, spoke a few appropriate and appreciative words in the interests of the Club.

The seventh and final excursion of the season was held at the Experimental Farm, on the afternoon of Saturday, June 13th, and was well attended. Mr. Arthur Gibson, the President, Mr. W. T. Macoun, and other representative officials of the Farm, escorted the party through the arboretum, the greenhouses and the insectary. The horticultural observations of the trees, hedges and flowers were inspiring. A number of the bird-nesting boxes placed on the trees were observed, and a few birds were seen. The display of grapes, tomatoes, cucumbers and melons seen in the greenhouses was an interesting sight, and the visit to the insectary was also interesting. Towards the close of the afternoon a visit was paid to the Entomological Museum, where Mr. Gibson exhibited a portion of the collection of mounted insects. This collection is so vast that a whole afternoon would require to be devoted to its inspection in order to get any adequate idea of its significance and value.

ANDREW HALKETT,
Chairman, Excursions Committee.

BOOK NOTICES.

BIRDS OF NEW YORK.—By Elon Howard Eaton. Part 2, General Chapters; Land Birds. New York State Museum, Albany, N.Y., Memoir 12.

In the June, 1910, issue of THE OTTAWA NATURALIST, we noted the appearance of Part 1, a volume of 390 pages; of the Birds of New York, which volume discussed the Water Birds and Game Birds. Part 2, as above mentioned treats of the Land Birds and is truly a magnificent contribution to American ornithology. It is a much larger volume, consisting of 543 pages. In Part 1, there are 42 full paged coloured plates, whereas in Part 2, there are no less than 106.

With the presentation of Part 2, the entire field of work as originally planned by the author is covered. Students of birds everywhere will be delighted at the completion of this exhaustive memoir. The coloured plates, which are from drawings by Mr. Louis Agassiz Fuertés, are indeed excellent in every way.

The introductory charter of Part 2 discusses Bird Ecology (pp. 5-46.) This is followed by a chapter on The Economic Value of Birds (pp. 46-51.) In the author's own words "the main value of birds is in holding tree and crop enemies in check. Modern methods of fighting injurious insects seem, in some cases, to render the aid of birds unnecessary, but the special value of the bird's work consists in attacking insect pests which are not reached by poison spray and at seasons of the year when spraying is not practised, thereby preventing outbreaks which otherwise would cause great destruction and expense." In this chapter the value of birds as weed seed destroyers is also discussed. Other chapters which follow are "The Status of our Bird Laws," "Special Measures for Increasing Bird Life," "Bird Refugees" and "Private Preserves." These are all of extreme interest. Then follows the main portion of the work, viz., the description of genera and species of the land birds. This occupies pages 61-541. Many text figures appear in this part. The Birds of Prey are first treated of. Each species is discussed under sub-headings, such as description, distribution, habits, etc. These are followed by an account of the Paroquet, the Cuckoos, Kingfishers, etc., the Woodpeckers, the Swifts, etc., etc., until a complete treatment of the land birds is given.

Canadian students will indeed welcome the final part of this magnificent work on the Birds of New York. The New York State Museum is to be congratulated in issuing such a beautiful and useful memoir. To the author every credit is due for the final appearance in such delightful form of years of labour. The plates by the well known artist, Mr. Fuertés, will certainly be admired by all bird lovers. The cost of issuing such volumes is, of course, extremely high and for this reason personal copies will be expensive and possibly difficult to obtain. The chief public libraries, however, in Canada should endeavor to obtain these two volumes for use in their reference reading rooms. Owing to the large number of persons interested in our native birds there would undoubtedly be many applications for the use of the books.

A. G.

HANDBOOK OF THE ROCKY MOUNTAINS PARK MUSEUM.—By Harlan I. Smith. Canada, Department of the Interior, Dominion Parks Branch.

This very useful handbook of 126 pages has recently been received. It has been prepared with the intention of giving to the public now a reference guide to the natural history of the whole region in and around the Rocky Mountains Park, at Banff, Alta. In Chapter 1, on the "Geography of the Rocky Mountains Park, a list of the important mountains, with their altitude is given, as well as a list of the living animals in the Zoo and the Paddock. Under Chapter 2 on Mammals," the different species are discussed in an interesting manner. Chapter 3 treats of the Birds, Chapter 4 the Fishes; Chapters 5, 6, 7 and 8 discuss Reptiles, Amphibians, Shellfish and Insects. These latter chapters are brief and do not mention any of the species. Chapter 9 describes many of the Trees found in the Park. Chapter 10, on "Minerals," 11, on "Rocks," and 12, on "Fossils" are also brief. Chapter 13 is on "Weather," 14 on "Antiquities," 15 on "Indians" 16 on "History" and 17 on "Literature of the Rocky Mountains Park."

The handbook will doubtless be well received by many visitors to the Banff Museum and Park. A. G.

THE BURDOCK GELECHIID

AN INSECT SEED-DESTROYER.

A very common but useful little insect which occurs in eastern Canada is the Burdock Seed Gelechiid, *Metzneria lappella* L. In the Ottawa district there is no difficulty whatever in finding in autumn and during the winter months, the curious little larvæ snugly concealed in the seed heads of the Lesser Burdock, *Arctium minus*. So abundant has the insect become that it is the exception to find a seed head in which the small caterpillar is not wintering. Oftentimes two larvæ are found in the same head. If a seed head is examined several of the seeds will be found to be fastened together and if these are separated the white larva, with a brown head, will be seen in its hibernaculum. It is a short, plump caterpillar and when mature is about three-sixteenths of an inch long. In spring it transforms to the pupal state and the moth emerges towards the end of May or during June. On one occasion I reared from a small handful of heads, nearly one hundred of the moths. The moth is a delicate little species, expanding when the wings are spread about half an inch, the females being slightly larger than the males. The front wings are pale brownish, with darker markings of brown; the hind wings are of a slate-colour and bear long fringes.

The Burdock Gelechiid, a native of Europe and Asia, was first discovered in Canada by the Rev. Dr. Fyles, at Levis, Que., in September, 1898. Since, it has spread considerably throughout the Provinces of Quebec and Ontario. The species is abundant at Toronto, where Dr. A. Cosens has noticed the larvæ since 1904.

Regarding the introduction of the insect into Canada, Dr. Fyles, in the Annual Report of the Entomological Society of Ontario, 1899, states: "It may well be asked, How was this European insect advanced to Canada?" This probably is the correct answer: at Point Levi there is a quarantine station for cattle; and old country hay and straw are often landed with the cattle; and burs containing larvæ of the species have, at some time, been landed with the fodder. The Burdock is plentiful on all our roads."

ARTHUR GIBSON.

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GEOLOGICAL SURVEY MUSEUM WORK ON POINT PELEE, ONT.*

Summer 1913 (See ON 1915 p 75)

BY P. A. TAVERNER.

In following out a scheme for illustrating the various faunal areas of the Dominion in the Museum of the Geological Survey, Ottawa, by large landscape groups showing the characteristic plants, animals, etc., of each marked division, it was decided to begin the work in southern Ontario, which from its striking characteristics and accessibility was obviously a natural starting point for the work.

Point Pelee, Essex County, near the western end of Lake Erie, was the chosen point of operation and on May 15th a Museum party, composed of Messrs. C. H. Young, C. L. Patch, and the writer arrived on the Point. Delayed by unavoidable circumstances our arrival was too late to catch the early migrants but, as the season was cold and the migrations delayed, this was not as serious as it might have been in a more normal year.

A considerable amount of work has been done and results published† relative to this region, by various ornithologists, mostly since 1905, but no continuous series of observations have been carried on there hitherto in summer months.

Owing to the fact that our attention had to be turned principally to collecting, for our exhibition group, a great amount of strictly scientific work was precluded, but general conditions proved so interesting that the most salient features seem worthy of record.

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†See P. A. Taverner and B. H. Swales—Birds of Point Pelee, Bull. Wilson Ornithological Club, 1907-08. Nos. 59-62, and various notes and short papers by the above and W. E. Saunders, in the pages of the Ottawa Naturalist.

We remained until July 24th, when the fall migrations were just commencing. We regretted greatly not being able to continue our observations during the early part of the fall migrations, as they would have completed and rounded out the work previously done in the locality in a most satisfactory manner.

The most striking feature of the summer bird population was the scarcity or total absence of several species common in the surrounding country and of expected occurrence here.

Some of the most noticeable of these species were:—

Wood Thrush, Wilson's Thrush, Ovenbird, Least Flycatcher, Scarlet Tanager, Rose-breasted Grosbeak, Warbling Vireo, White-breasted Nuthatch, Blue-grey Gnatcatcher.

All these species are conspicuous either by their plumage or notes and could scarcely have been overlooked by us. The cause of their absence raises an interesting question, as there are seemingly good habitats for them on the Point, and no obvious reasons for their absence.

On the other hand, the breeding populations of Chipping Sparrow, Wood Pewee and the Baltimore and Orchard Orioles were unusually large. Chipping Sparrows haunted almost every corner of the dry land of the Point throughout the summer and constituted perhaps a quarter of the total bird population. Wood Pewees could be heard nearly every minute of the day in every suitable locality. The two Orioles, Orchard and Baltimore, were more than common, approaching abundant. Their rich varied songs made every daylight moment delightful.

From reports received we had been prepared for a large falling off in the number of Cardinals, but were agreeably surprised to find them in their old numbers. Like reports of the Carolina Wren, however, were only too true. This species, after being common ever since regular study has been given to Point Pelee bird life, i.e., since 1905, have, apparently at least, succumbed to the rigors of the climate and not one was found or heard during our stay*. This species is resident wherever found and undoubtedly the past winter or the past two winters were too severe for it. Its loss will be keenly felt by those who remember its far carrying liquid notes that added such a charm to the locality. The writer remembers one 22nd of February, a bright sunshiny morning, the ground white with snow, but the air carrying the greatest flood of bird music he ever heard.

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*Mr. W. E. Saunders tells me that since our visit a few Carolina Wrens have again put in an appearance and promise to rejoin their old numbers.

Cardinals and Carolina Wrens answered each other back and forth in almost continuous strains to a running melodic background from flocks of Purple Finches and underlying all, a low, sweet monotone accompaniment from the combined efforts of innumerable Redpolls. It is to be hoped that the Carolina Wren will re-establish itself on the Point.

Though the Carolina Wren has gone we were delighted to find the Mockingbird still doing well. We failed to either see or hear them for a considerable time after our arrival, but on June 13th one lit in the top of a red cedar in front of the camp and serenaded us for several minutes. Later we found that a pair had established themselves in the vicinity of a farm house not far away and, as the local inhabitants are beginning to take pride in having the only genuine wild Mockingbirds in Canada, they undoubtedly had favorable conditions for raising a nestful of young.

Among other interesting nestings was that of the Lark Sparrow. There were at least three pairs established not far from our camp, at least one of which raised a brood, as we saw the fledglings just after they had left the nest.

The Dickcissel was also observed after many years of absence from Point Pelee notes. About half a dozen pairs were found on the reclaimed ground at the base of the Point. They were evidently breeding in the clover fields but the rank luxuriance of the growth prevented our finding the nests.

On June 5th, two Least Bitterns got up from the edge of a small pond in the marsh and crossed together to the far side, where they were both, shortly after, secured by Mr. C. H. Young. One proved to be a Cory's Bittern, *Ixobrychus neoxenus*, female. In view of its apparent close association with an individual of the closely allied species, from which there is even yet some doubt as to its specific distinction the bird's genitalia was examined with some interest. The ovaries were but slightly developed and there could be no question as to its non-breeding condition. The specimen under question is a normally colored individual showing the usual albinism of the species in but a single white feather on the left leg close to the joint.

Lincoln Sparrow has been taken regularly enough at Point Pelee to be classed as a regular migrant, but the great number of this usually rare bird that were present on May 23rd and 24th warrants special mention. These two days we positively indentified 15 and 10 specimens respectively and then gave up scrutinizing the omnipresent Song and other ground sparrows. Without doubt, careful attention to this one secretive species would have revealed several times as many more.

May 29th was notable for the number of Philadelphia Vireos; twelve were positively separated from the Warbling Vireo also present, after which no special pains was taken to distinguish the species. They were too common to arouse interest.

The taking of a male Prothonotory Warbler, *Prothonotoria citrea*, on May 19th, was one of the events of the season. There are some few records of the species for Canada but they are poorly supported by extant specimens. This appears to be the third record for the Dominion, the first being Boardman's New Brunswick record and the second McIlwraith's, Hamilton, Ontario, bird.

The Orange Crowned Warbler is one of the rarest of the regular warblers in Ontario. Though the past few years has seen more of this species taken at Point Pelee than, perhaps, all the remainder of eastern Canada together, it was a matter of some congratulation to secure one on May 16th.

The last record of the Short-billed Marsh Wren at the Point was May, 1905, when a small colony of them were observed near the base of the Point. It was, therefore, with considerable pleasure that we located several pairs of them, along the west side of the marsh not far from camp. On May 29th and June 2nd they were again observed; though we searched carefully no nest could be discovered.

It is to be regretted that circumstances recalled us to Ottawa when they did as we missed the early part of the fall migrations thereby. The waders were just returning as we left and the following return species were noted, Least Sandpiper, Semipalmated Plover, Yellow-legs and Hudsonian Curlew. No one has so far recorded the opening days of the fall migrations at this famous migration station and we regretted not being able to take advantage of the opportunity.

Among the plants a number of interesting species were collected for reproduction in the intended group. Not quite all species required were to be found on the Point itself and some searching of the adjoining main land was necessary to secure them.

Near Leamington were found considerable numbers of Sweet Chestnuts, *Castonea dentata*, and some magnificent specimens of Tulip Tree, *Liriodendron Tulipifera*. It was a little late in the season before we found these latter and it may be of interest to state that we were forced to shoot with a rifle the blossoms we wanted from the tips of the high branches.

The Pawpaw, *Asimina triloba*, also required some searching for but at last was found on the main land nearby. The trees found were, comparatively speaking, small saplings, but we heard of one, not far away, with a trunk eight inches in diameter.

Sycamore, *Platonus occidentalus*, also grows to great size on the Point, but the gnarled state of the branches show that it has reached the northern limit of its range. An occurence just before we arrived showed the cause of the dense clumps of twisted twigs, withches brooms, and the strange irregular twists and angles of growth, that adorn the branches of most of these trees on the Point. A frost came after the first leaves had opened, blighting them and the delicate twigs they were giving rise to. For some time thereafter all appearance of terminal growth stopped but later shoots were thrown out at the sides, which being in new directions, formed fresh angles in the crooked growth of the limbs and bunches of bushy sprouts about the joints. This injures the appearance of the trees but evidently has but little effect on its general health. From the appearance of most of the trees it would seem that these late frosts blight the sycamore, on Point Pelee, in this manner most years.

One of the most common trees is the Hackberry, *Celtis occidentalis*, which grows to great size. Its bark is deeply and closely longitudinally ribbed. The ribs sometimes being an inch high, and a quarter of an inch apart. It has a small fruit, black when ripe, much liked by birds, especially the Evening Grosbeak and the Waxings.

The Poison Ivy, *Rhus Toxicodendron*, var. *radicans*, is also interesting to the visitor from other parts of Canada who knows the plant only as a low growing or trailing vine. Here it assumes great size and we brought home a trunk four inches in diameter and fourteen feet long. In one case we saw where an ivy vine had grown to even larger proportions about a tree which subsequently died and rotted away, leaving the clinging vine standing like a tree with great forked branches reaching out in true limb-like pose.

The Wild Grape, *Vitis bicolor*, grows to great size. One old and decayed vine measured eight inches in diameter at base, and must have run up thirty feet from the ground without branch or foliage.

In the marsh grows the Marsh Mallow, *Malva moscheutos*, a pink hybiscus of hollyhock-like aspect and striking beauty. Another plant not growing on the Point but found in some of the streams emptying into the Detroit River nearby is the American Lotus, *Nelumbo lutea*, a plant of such tropical characteristics as to seem quite out of place in our Canadian flora. Its leaves stand up some eighteen inches or more from the water on stiff round stems, each surmounted with a circular pad nearly two feet in diameter, balanced in the center like a spinning plate on a juggler's wand. The flower is like a large water lily six inches in diameter and of a rich cream color, having a yellow green seed pod in the center, of curious form, studded with the projecting heads of acorn-like seeds.

The Red Mulberry, *Morus rubra*, is not an uncommon tree and occurs in scattered individuals throughout the hardwood section, growing in some instances into large forest trees. Evidently they do not bear fruit every year, as some that we were informed bore profusely the previous year were this season barren and others were well laden that had not been observed fruiting before. Though the habit of growth at the ends of the branches of large trees makes the fruit difficult of gathering, we secured several lots of berries for the table and found them delicious. The great variety in shape of the leaves is surprising and seems to be largely characteristic of individual trees, though partially an effect of age. Young trees always show much variety of leafage shape, and old ones frequently do so.

Sassafras, *Sassafras voriifolium*, is very common and occurs to considerable size. A like variation of leaf shape is shown in the species, variation always appearing in young shoots and frequently in the old trees.

The most striking plant on the Point, however, is the Prickly Pear, *Opuntia Rafinesquii*, a cactus growing low on the ground, but of typical cactus form and shape and more than usually well armed with many clusters of minute hair-like prickers and a few scattered thorns of heavier growth. It occurs in more or less circular beds on the driest soil and blossoms profusely. The flowers are some two and a half inches across and of a bright lemon-yellow color. A bed in full bloom is a most striking sight. The plant is very hardy and can stand the extremest aestivation. Bits and lobes that we brought home without earth and never watered remained fresh and solid looking for several months, and some belated blossoms opened out nearly seven weeks after being collected.

We also found some interesting reptile life. Melanism, the occurrence of black individuals in a species normally otherwise colored, and the opposite of albinism, occurs in many species, but is usually very rare. There appears, however, to be on Point Pelee a race of Garter Snakes specially prone to this color aberration. We have taken black Garter Snakes here on other visits and obtained several this trip. On our return to Ottawa we brought with us quite a number of live snakes. Among them was a normal colored Garter Snake which shortly afterwards brought forth 35 young. Of these two were perfectly black or melanitic specimens, all the rest being of the usual striped coloration of the mother.

The Hognosed snake, *Heterodon platyrhinus*, is common on the dunes of east beach, where it usually spends the day under drift wood and logs, coming out at night to forage. The species seems to occur in two forms, a bright yellow and black one, and another form dusty gray with the bright yellow and black markings, veiled and but dimly visible. Though the most harmless of reptiles it has a most venemous aspect when aroused and cornered. It is popularly called "Blowing Adder" and generally regarded so deadly that even its breath is poisonous. When unable to escape an enemy, it coils at bay with its head and body raised from the ground about one-third its length, the head flattened and the chops protruded. Gradually the flatness and protrusion extends down the sides until the whole upraised portion assumes a ribbon-like aspect, perhaps an inch and a half across and less than half an inch through at the center, thining out to almost nothing at the edges. In this attitude, as it faces its enemy, it is indeed a threatening sight, the more so as it "blows" with a distinctly obvious sound and makes passes, as if to strike with wide open mouth. But, to use a colloquial phrase, this is but a bluff, and if the enemy stands its ground the strike so determindly initiated ends with a futile stroke of a soft mouth that can not scratch the tenderest skin.

An occasional individual will carry the game into a still higher form of deception. Finding that its threatenings fail to alarm the aggressor it falls into an apparent fit. Writhing and squirming on the ground, it twists and bites the dust, filling its mouth with sand as it bores its head helplessly into the ground. Gradually the writhings grow fainter and weaker until they cease and the snake lies, belly upward and to all appearances dead. The simulation is close but careful examination shows it slightly over done; for instance, the snake refuses to lie right side up and every attempt at making it do so calls forth a weak spasm which throws it on its back again. Also the limp body will not balance over a stick or on the hand, however carefully the adjustment is made as to weight; unless it is forcibly held, one end always seems a little heavier than the other and the body slides off to the ground. This comatose condition lasts until the snake thinks the coast clear, when with a sudden jerk it rights itself and if not again molested glides off quickly to the nearest safe retreat; but should it find that the attack is renewed it goes through the whole process of dying over again.

Fox Snakes, *Elaphe vulpinus*, were also common on the same sand dunes. They are colored much like the Adder, but are a slenderer and more gracefully-shaped snake. We found them easily by following up their winding tracks in the sand from willow clump to willow clump, and at last usually discovered them under rotten logs. About the middle of July we found three females under one log with almost a peck of eggs. The eggs are elliptical in shape and covered with a tough leatherly shell that seems to stick together as fast as laid, making clusters like bunches of grapes.

In turning over the logs on the beach for snakes and mice we also found considerable numbers of Blue-tailed skinks, *Eumeces quinquilineatus*. These are locally called Swifts and on a bright warm day the reason of this name is obvious, for they run very rapidly, and it takes considerable agility to catch them, especially as care must be taken to grasping them by the body and not by the tail for the latter breaks off at the least strain, leaving the tailless lizard free to vanish into the debris. The young and half-grown individuals are most beautiful little creatures. All are of the most clean and shapely form with pointed head, slender body, dainty limbs and long, gracefully-tapering tail, but the younger ones have the added beauty of color. The body is coal-black with bright yellow stripes, hence another popular name—and one from which its scientific cognomen is derived—Five-lined Skink. The tail at these ages is a bright sky blue almost irridescent in tone. The adult animals are much soberer, a dull olive-green, with slight bronze reflections to the scales and vague yellowish stripes along the back and sides.

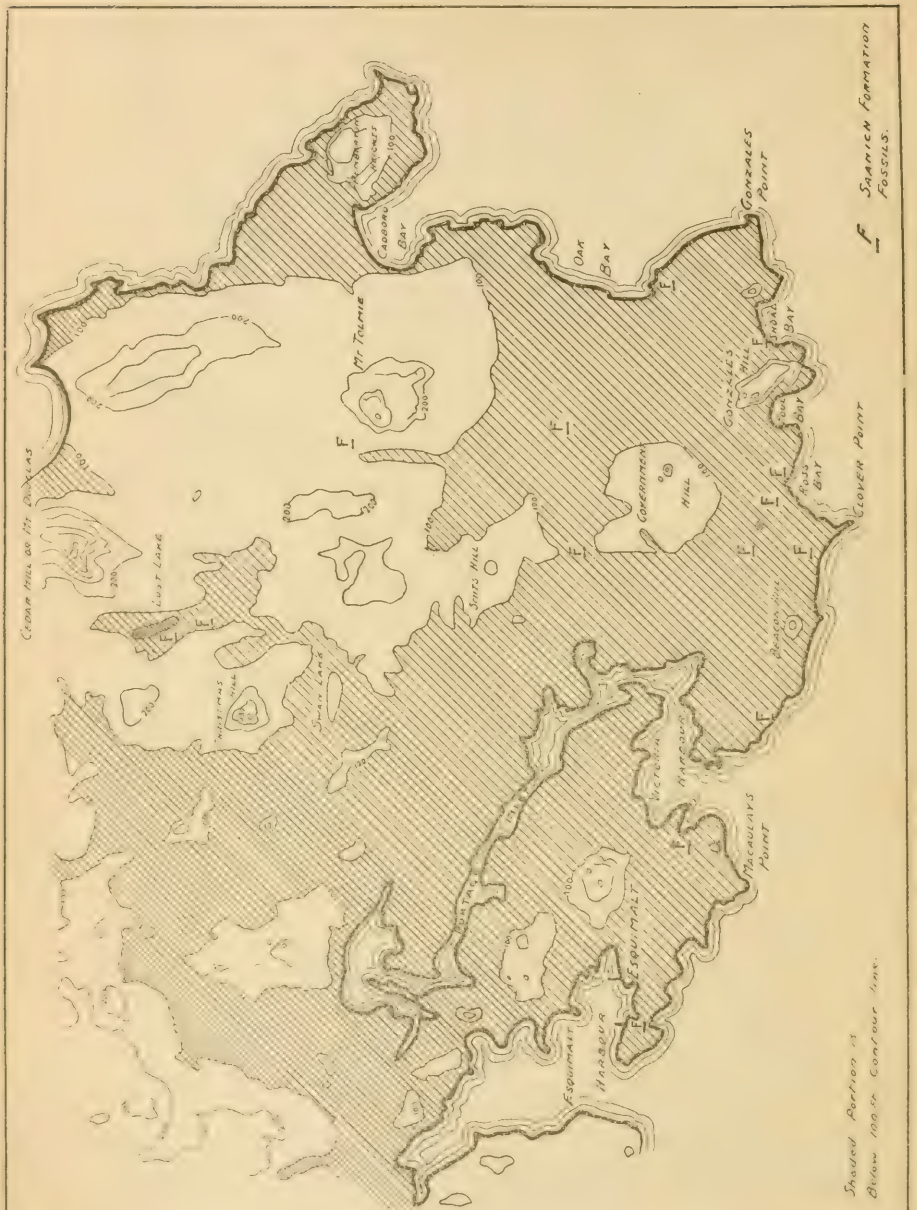
We found several sets of eggs in the cavities of well rotted logs. In all cases an adult was present with them, so it is likely that the mother takes more care of her young than is common among the reptilia. Other specimens captured alive laid eggs in captivity and we managed to hatch out a number of them. Our captives ate ant pupae and flies greedily, which gives us a suggestion as to the nature of their food.

With fish very little was done but to collect some Gar Pike, *Lepidosteus osseus* and *L. platostomus* and Dog Fish, *Amia calva*. We found an adult of the latter in shallow water at the end of the drainage ditch with a school of young.

They schooled close together and occupied a space when closely massed about the size of a bushel basket, while the old one swam about near by, occasionally vanishing for a few minutes but always reappearing again shortly. The Dog fish is one of our most interesting forms, being a survival of a very ancient type with the tail formed from the ventral fin. This peculiar tail formation shows very plainly in the young, of which we collected quite a number.

Among insects a little more was done. The beautiful Olive Hair-streak, *Thecla damon*, was very common the latter end of May on the Red Cedar and a considerable series was collected. One of the most interesting occurrences, however, in this line was the comparative abundance of *Papilio ajax*. The commonly given food plant for this showy butterfly is the Pawpaw. This, however, does not occur on the Point and the nearest clump of it is more than six miles away across a wide marsh, yet we saw the species nearly every day and often from two to six. They flew swiftly and were difficult to capture. Those we managed to take were in almost unworn condition and the majority of those seen were perfect even to the ends of their long swallow tails. It hardly seems possible that all of these should be wanderers from the little clump of Pawpaw in the main land and probably the species has another food plant on the Point. *Terias lisa* was quite common, *Colias eurytheme* was seen several times and taken once. Specimens of *Libythea bochmanni* and *Junonia coenea* were observed and indentified as certainly as possible by eye sight, but no specimens were taken.

Among the mammals of course the work was limited, by the species remaining after many years of hunting and extermination. All the larger land forms have disappeared, even to Skunks and Raccoons, and at present the Muskrat is the largest native mammal inhabiting the Point. We trapped mice extensively, and found the rare Michigan or Baird's Deer Mouse, common on the beaches. The Common Mole is abundant everywhere in the sandy fields. The Flying Squirrels taken proved to be of the small southern form, and the rabbit is the common Cottontail of southern Ontario, and no hares are to be found.


Cedar Hill or Mt Douglas
Lost Lake
Henderson Heights
Cadboro Bay
Mt Tolmie
Oak Bay
Gonzales Point
Shoal Bay
Foul Bay
Gonzales Hill
Government Hill
Ross Bay
Clover Point
Smiths Hill
Beacon Hill
Christmas Hill
Swan Lake
Victoria Harbour
Macaulays Point
Portage Inlet
Esquimalt
Esquimalt Harbour
100
200
F
F Saanich Formation Fossils.
Shaded Portion is Below 100 ft Contour line.

From Topographical Map 20 A., Geol. Sur., Can., Victoria Sheet.

Illustrating article on Pleistocene Raised Beaches at Victoria, B.C., by C. F. Newcombe.

PLEISTOCENE RAISED BEACHES AT VICTORIA, B.C.

BY C. F. NEWCOMBE, VICTORIA, B.C.

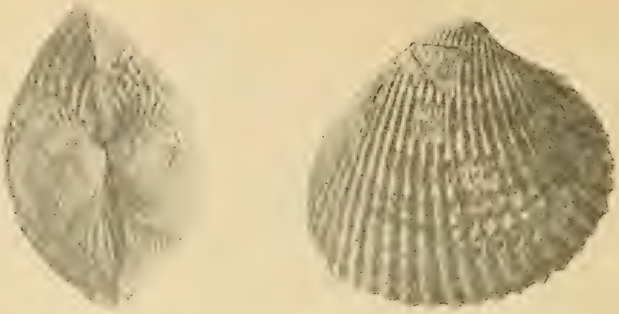
Dr. C. H. Clapp's recently issued article on the Geology of the Victoria and Saanich Map-Areas, Vanc. I., B.C., Memoir No. 36, of the Geological Survey of Canada, includes a very notable contribution to the classification of the superficial deposits in the district treated of.

He makes no distinct mention, however, of certain features which have long been of great interest to local amateur geologists,—the numerous deposits containing marine shells found near the present surface, but usually underlying a peaty layer of no great depth. These, so far as I can make out, are superimposed on the Maywood clays of Clapp, lying in shallow depressions in places where, at the time of their deposition, they were little exposed to disturbance by tides or storms.

The peaty layers contain freshwater shells of species still living in this neighborhood, and some of the localities have only been drained quite recently, and are margined by swamps with sphagnum, *Betula glandulosa*, *Ledum*, etc. The marine shells frequently retain their valves in apposition, and in many cases even the cartilaginous hinge is entire.

The earliest notice I can find of these interior raised beaches is a note by Mr. James Richardson in the Report of the Geological Survey for 1871-2, p. 94, where he reports a shell-bed to the east of the Saanich road, at a height of about three hundred feet above the sea.

The first beach of the kind examined by the writer was one to which attention was called by Mr. F. Pemberton, of Victoria in 1889. He told me that during the removal of black soil from the family estate, near Ross Bay Cemetery, for the late Mr. Robert Dunsmuir's new grounds at Craigdarroch, a large quantity of shells were being exposed under the peat. I found that under a foot or two of decayed vegetable matter containing freshwater shells were the following marine species: *Cardium corbis* Mart., *Macoma calcarea* Gmel., *Mya truncata* L., *Mytilus edulis* L., *Saxicava arctica* L., and *Saxidomus giganteus* Desh.



Cardium decoratum Grnk.

Three years later, in company with Dr. Hasell, of Victoria, I collected at Mount Tolmie all of these species and an additional *Cardium* now no longer living in these waters, *C. decoratum* Grnk. (My diagnosis was confirmed by Dr. Dall, of Washington). The first locality is at an elevation of about thirty feet above present sea-level; that of the second at about one hundred and ten, according to the new contour map of the Saanich Peninsula, —the greatest height at which I have found similar marine shells.

Passing over many minor localities mention may now be made of a typical one at the shallow and much diminished Lost Lake, near the foot of the prominent monadnock called Cedar Hill or Mount Douglas.

This lake lies at an elevation of eighty-three feet at a distance of about four miles from the Victoria post office. In 1894, when Mr. Nicholson, the owner of a large farm bordering on the lake, was extending his drains, a typical condition of things was found, as described at the beginning of this note, with all of the species of marine shells mentioned, lying under a thick layer of imperfectly formed peat.

At the present time the Canadian Northern Railway is endeavoring to find a footing for their road-bed through the lake by driving piles through the shallow bottom. At the last time of my visit they had reached a depth of more than one hundred feet without finding sufficiently firm ground. On the side of a shallow cut here I noticed *Macoma nasuta* and *inquinata*, in addition to the species already noted. It was in this region, though not clearly identified, that Mr. Richardson collected his specimens referred to.

But the most productive area that has come to my notice is one much nearer to Victoria, and which I explored early in this year on behalf of General de Lamothe, of Paris, who visited Victoria in company with several Canadian geologists last year after the meeting of the International Congress. Following along the line of a hollow between Spring Ridge and the Protestant Orphanage, where I had previously made many finds, I at length found a recently constructed main sewer passing through an abandoned vegetable garden, bounded on the west by Cook Street.

Again, after digging through an extensive peat bed, containing freshwater shells in perfect condition, at about four feet from the surface vast quantities of marine shells had been exposed, together with two species of barnacle and a few fragments of elk-horn, apparently cut by a blunt instrument.

Here I added to my list the following Gastropods: *Natica clausa* B. & S. (of immense size), *Natica pallida* B. & S., *Margarita pupilla* Gld., and *Acmaea alveus* Conr., a species which lives on eel grass growing in shallow, quiet waters. To the bivalves were added a *Macoma* like *balthica* L., *Paphia staminea* Conr., *Schizothaerus nutallii* Conr., and *Zirphaea crispata* L.

About three years ago Mr. Harold Hannibal, of Stanford University, Cal., visited Victoria and accompanied me to the Pemberton locality first noted above, and, later, examined alone, the Lost Lake region. The results of these examinations and of explorations in the Puget Sound country is given in a report by Dr. Ralph Arnold and himself entitled "The Marine Tertiary Stratigraphy of the North Pacific Coast of America," contributed by them to the Proceedings of the American Philosophical Society, Vol. LII, No. 212, 1913. To the raised beach formations just mentioned and to similar ones in Puget Sound and the Strait of Georgia, the authors, on page 597, apply the name The Saanich Formation (Pleistocene).

A partial list of fossils collected by various geologists and by myself in Victoria, and on the shores of various places to the north and east was published by me in the Catalogue of the Provincial Museum, Victoria, in 1898. This list will require considerable revision in the light of later knowledge. The species named include many which were found in the lower clays forming steep cliffs here and near Comox, and islands in the Strait of Georgia, and also from the sandy layers superimposed on Cretaceous rocks at Sucia Island. Mr. Bauerman, Dr. G. M. Dawson and Mr. Lamplugh, of the Geological Survey of Great

Britain, were the most noteworthy collectors, and I was able to add a few species to their lists in after years. The relationship of these clays, in which are *Ledas*, *Buccinums* and other species indicating deeper water than those noted in the Saanich formation, has not, to my mind, been satisfactorily determined.

THE SNOW-FLEA.

By CHARLES MACNAMARA, ARNPRIOR, ONTARIO.

In this part of Canada the coming of winter practically marks the seasonable close of visible insect life, and with the first snow most collectors put up their nets, forceps and bottles. But to this general rule there are exceptions, and occasionally one finds on the snow a torpid fly or spider that the winter winds have blown out of some crevice, or sometimes on a mild day a woolly-bear caterpillar is seen hurrying along as if late for an appointment. These, however, are merely accidental apparitions, and the only insect that can be said to occur regularly during the winter months is the springtail.

These tiny insects belong to the order Thysanura, and form the sub-order Collembola. They are the most widely distributed hexapods in the world, having a range from the Arctic to the Antarctic and are found high up on mountains and down in the deepest caves. Excluding parasites on penguins and seals, which may be regarded as importations, the only indigenous insect in the Antarctic continent is said to be a springtail. Only in view of their absolutely wingless condition, the wide distribution of these small and delicate insects points to the great antiquity of the order, and they are thought to represent a very early offshoot of the ancestral stock of Hexapoda. All the species are very small, ranging from one-half a millimeter to five millimeters in length, but those of the latter size are the giants of the race; most of them are from one to two millimeters long. They frequent dark damp places, as under moss and rotten wood, and owing to their minute size are difficult to discover.

They gain their common name from their peculiar springing organ. Towards the caudal end of the abdomen are attached a pair of tail-like appendages, together called the furcula, which are normally bent forward, under tension, beneath the insect, and the ends are held in a little catch known as the tenaculum. When released from the tenaculum, the furcula kicks forcibly downwards and backwards and jerks the insect into the air. Anyone who remembers the goose bone jumping-jack—a homely toy unknown, I fear, by the present sophisticated generation of children—will readily understand the springtail's leaping apparatus.

At least four species of Collembola occur in the vicinity of Arnprior during the winter:—*Isotoma nigra* Macg., *Achorutes nivicola* Fitch, and two unidentified species. *I. nigra* is fairly common, and sometimes forms the majority of the springtails found on the snow, but generally *A. nivicola* is in excess, and towards spring often appears in such vast numbers that the most casual observer cannot fail to notice it. From its jumping habit it is popularly known as the "snow-flea," although, of course, it is not related in any way to the real fleas, (Siphonaptera).

A. nivicola, which Dr. J. W. Folsom identifies with the *A. socialis* of Europe, may be described untechnically as a blue-black insect two millimeters long by one-quarter millimeter wide at its broadest part. It has a well marked head, bearing two somewhat divergent short antennae which it keeps in constant motion. Its mouth parts are sunk in the head, a peculiarity characteristic of all the Collembola. Its sixteen simple eyes are arranged in two groups of eight each on either side of the head. It has an elongated but stout segmented body, the thorax consisting of three segments each bearing a pair of short legs on which the insect runs very actively. The abdomen has six segments and tapers rapidly towards the tail. The jumping apparatus is as already described. The whole insect is sparsely covered with short fine hairs.

Any day of the winter, from November to March, when the temperature is not below 30° F., *A. nivicola* can be found on the snow near old log fences, and along roads and clearings. They seem always to occur along the edge of open spaces of some kind, and I have never observed them in the middle of a wood of any extent. Although they sometimes come out in considerable numbers in November and December, the really great swarms do not appear until the first mild days of spring. Towards the end of March one often sees them like thickly scattered grains of gunpowder on the snow near the foci from which they spread. They tumble into every slight depression, and as their movements are rather aimless they do not readily escape from such situations, and every little hollow in the snow is black with them. A friend tells me that he once saw them near the Deschenes Rapids in such quantities that they could have been scooped up in spoonfuls. Of course, as they spread out they become much more thinly scattered. Their progress is slow and apparently rather haphazard, and their distribution is influenced a good deal by the wind, but their general movement is always towards open spaces. A day or two of favorable weather enables them to spread over a large area of country. I have seen them extending to a distance of a half mile from the shore on the ice of the Ottawa River, and on an eight-mile walk on the 26th March, 1914, they were found scattered everywhere over fields, clearings, beaver-meadows and lake.

The object of these migrations is not very apparent, and there is no doubt that the vast majority of the migrants perish in the snow before reaching any goal; but possibly inter-breeding is thus prevented and the racial benefit so derived more than counterbalances the immense destruction of individuals.

On the 24th April, 1914, by which date the snow had all gone, I found large numbers of *A. nivicola* under chips in a damp place on the shore of Chats Lake. The insects were gathered in masses, and to the naked eye, looked like patches of dark blue powder. I collected some in a vial, loosely filled with damp moss, and on the 27th, they laid from seventy-five to one hundred tiny, spherical, yellowish, eggs in lots of fifteen or twenty, something like bunches of grapes. These hatched out on the 9th May, an incubation period of twelve days. The young emerged perfect, (none of the Collembola undergo any metamorphosis), but instead of the blue-black of the adult, they were yellowish-white in color with conspicuous dark eye spots. They were exceedingly active, and kept continually running and jumping about in their bottle. The adults all died about this time and the young survived them only a few days. *A. nivicola* disappears from its winter haunts during the summer, and is very hard to find between May and November, but this is not surprising, as the insect is so small that unless it occurs in very large numbers, it is difficult to discover without the white background of the snow to betray it.

THE OTTAWA NATURALIST

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LIST OF TACHINIDÆ FROM THE PROVINCE OF QUEBEC.*

By J. D. Tothill.

The following list contains 49 species of Tachinidæ from the province of Quebec. A number of the species were captured at Ottawa, but as this place is only separated from the province of Quebec by the Ottawa river, it is certain that all these species must occur in the neighbouring portions of Quebec and for this reason it seems advisable to include them in the present list.

It is certain that this list represents only a very small proportion of the Tachinidæ that must occur in this large province. Many of the most common species, for instance *Tachina mella* Walk. and *Frontina frenchii* Will., do not appear in the list. This means that collectors in this province, either amateur or professional, would be well repaid by turning their attention to the group.

The list has been compiled from two sources: (1) the collection of the Entomological Branch at Ottawa, and (2) records contained in literature. In the case of records from the former source the precise locality is stated and this is followed by the collector's name in parenthesis. In the case of records from the latter source the name of the person responsible for the original record is given; in all cases where the record appears in Aldrich's Catalogue of N. A. Diptera (1905), reference is made to the original publication containing the record. The references are made by a letter index.

The majority of the species in the present list were originally recorded by Mr. G. Chagnon in his "List of Canadian Diptera" which appeared in the *Entomological Student*, Philadelphia, Vol. II, 5-8 and 13-15; and by Dr. T. W. Fyles, in his "Quebec Diptera," which appeared in the *Canadian Entomologist*, XXXV, p. 234, August, 1903. These records are embodied in Aldrich's "Catalogue," so that in the present list no specific reference has been made to the above two papers.

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*Contribution from the Entomological Branch, Department of Agriculture, Ottawa.

The order adopted is that of J. M. Aldrich.

Cistogaster immaculata Macq. P. Q.—Fyles (*a*).

Gymnosoma fuliginosa Desv. Montreal—Chagnon (*a*); Ottawa, (Col. by W. Metcalfe).

Alophora æneoventris Will. Ottawa, (Col. by J. D. Tothill).

Alophora diversa Coq. Montreal, (Col. by Beaulieu)—Gibson (*c*) 1911, p. 17.

Alophora magnipennis Johnson. Ottawa—J. Fletcher (*b*); St. Hilaire, P. Q., (Col. by Beaulieu)—Gibson (*c*) 1911, p. 17.

Alophora nitida Coq. Sherbrooke, P. Q.—Aldrich (*a*).

Cryptomeigenia theutis Walk. Montreal—Chagnon (*a*); Ottawa, (Col. by A. Gibson).

Eulasiona comstockii Town. Chelsea, P. Q., (Col. by J. Fletcher).

Admontia degeerioïdes Coq. Montreal—Chagnon (*a*); Ottawa, (Col. by J. Fletcher).

Clausicella johnsoni Coq. Ottawa—J. Fletcher (*b*) 1906, p. 102.

Hypostena variabilis Coq. Montreal—Chagnon (*a*); Ottawa, (Col. by W. Metcalfe).

Polidea areos Walk. Montreal—Chagnon (*a*).

Œstrophasia calva Coq. Ottawa—Harrington (*b*) 1902, p. 101.

Cyrtophlœba horrida Coq. Montreal—Chagnon (*a*); Ottawa, (Col. by W. Metcalfe).

Plagia americana Van der Wulp. Ottawa, (Col. by A. Gibson).

Ocyptera dosiades Walk. Montreal—Chagnon (*a*).

Varichæta aldrichii Town. Ottawa, (Col. by A. Gibson).

Linnæmyia picta Meig. Rigaud P. Q.—A. Gibson (*b*) 1911, p. 17.

Exoristoides harringtoni Coq. Ottawa—Aldrich (*a*).

Exorista cheloniæ Rond. Chelsea, P. Q., (Col. by J. D. Tothill).

Exorista eudryæ Town. Ottawa, (Col. by J. Fletcher).

Exorista futilis O. S. Ottawa, (Col. by J. Fletcher and A. Gibson).

Exorista nigripalpis Town. Ottawa, (Col. by J. Fletcher); Chicoutimi, P. Q., (Reared at Ottawa from larvæ of *Tortrix fumiferana*); Maniwaki, P. Q., (Col. by A. Gibson and G. E. Sanders).

Exorista pyste Walk. Chicoutimi, P. Q., (Reared at Ottawa from larvæ of *Tortrix fumiferana*).

Exorista vulgaris Fall. P. Q.—Fyles (*a*); Maniwaki, P. Q., (Col. by A. Gibson and G. E. Sanders); Chicoutimi, P. Q., (Reared at Ottawa from larvæ of *Tortrix fumiferana*); Ottawa, (Col. by H. Groh.)

Phorocera lophyri Town. Ottawa—Aldrich (*a*).

Phorocera saundersii Will. Ottawa, (Col. by J. Fletcher).

Frontina tenthredinidarum Town. Ottawa, (*a*).

Sturmia albifrons Walk. Ottawa, (Col. by J. Fletcher).

Sturmia inquinata V. d. W. Ottawa, (Col. by A. Gibson).

Sturmia nigrita Town. Rigaud, P. Q.—A. Gibson (*c*) 1911, p. 17.

Masicera eufitchiæ Town. Ottawa, (Col. by A. Gibson).

Masicera myoidea Desv. Ottawa, (Col. by C. H. Young); Meach Lake, P. Q.,—J. Fletcher (*c*) 1907, p. 21.

Tachina simulans Meig. Ottawa, (Col. by W. Metcalfe); Montreal—Chagnon (*a*).*

Tachinomyia robusta Town. Ottawa, (Col. by J. A. Letourneau).

Blepharipeza adusta Lœw. Ottawa, (Col. by A. Gibson).

Blepharipeza leucophrys Wied. Meach Lake, P. Q., (Col. by A. Gibson).

Winthemia quadripustulata Fab. Ottawa, (Col. by W. Metcalfe and Bro. Germain).

Metachæta helymus Walk. Montreal—Chagnon (*a*); Ottawa, (Col. by A. Gibson).

Phorichæta sequax Will. Ottawa, (Col. by A. Gibson).

Gonia capitata DeGeer. P. Q.—Fyles (*a*); Ottawa, (Col. byW. Metcalfe and J. Fletcher).

Spallanzania hesperidarum Will. Montreal—Chagnon (*a*),

Cuphocera fucata V. d. W. Montreal—Chagnon (*a*).

Peleteria prompta Meig. Montreal—Chagnon (*a*); Ottawa, (Col. by A. Gibson); Aylmer, P. Q., (Col. by H. Groh.)

Archytas analis Fab. Montreal—Chagnon (*a*); Ottawa, (Col. by J. Fletcher).

Echinomyia algens Wied. Quebec—Van der Wulp (*a*); Ottawa, (Col. by J. Fletcher and A. Gibson).

Echinomyia florum Walk. P. Q.—Fyles (*a*).

Saundersia signifera Walk. Montreal—Chagnon (*a*); Ottawa, (Col. by W. Metcalfe and J. D. Tothill). Dr. Fletcher, in 1904, reported the species as "unusually common at Ottawa" (*b*) 1904, p. 78.

Bombyliomyia abrupta Wied. Quebec—Van der Wulp (*a*);

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*In Aldrich's Catalogue of N. A. Diptera this species is recorded from Ottawa, and, for the record, reference is made to Coquillett's 'Revision' p. 119. In this 'Revision' the only Canadian locality given is Toronto so that an error has evidently been made in transcription.

Montreal—Chagnon (*a*); Meach Lake, P. Q., (Col. by A. Gibson); Ottawa, (Col. by J. Fletcher).

Literature cited:

(*a*) Aldrich, J. M., Catalogue of North American Diptera, 1905.

(*b*) Reports of the Entomological Society of Ontario.

(*c*) James Fletcher and Arthur Gibson. "The Entomological Record" to 1912.

BOOK NOTICES.

THE HOUSE-FLY, MUSCA *Domestica* Linn. ITS STRUCTURE, HABITS, DEVELOPMENT. RELATION TO DISEASE AND CONTROL. By C. Gordon Hewitt, D. Sc., F. R. S. C., Dominion Entomologist. Cambridge: at the University Press, 1914. Price 15 shillings net.

This book of 382 pages which has just been received, is undoubtedly the most comprehensive and complete volume which has yet appeared on the extremely common insect, which is abundant, unfortunately, everywhere, *viz.*, the House-fly. No insect of late years has received such world-wide attention as has the species here discussed. This, of course, has been owing to its relation to the spread of disease. The book is not intended as a popular treatise on the subject, but it has been prepared largely for the use of entomologists, medical men, health officers and others who would be interested scientifically in the matter presented. The volume is divided into six parts, *viz.*, Part I—The Structure and Habits of the House-fly; Part II—The Breeding Habits; Life-history and Structure of the Larva; Part III—The Natural Enemies and Parasites of the House-fly; Part IV.—Other Species of Flies Frequenting Houses; Part V—The Relation of House-flies to Disease; Part VI—Control Measures. Three full page coloured plates and 104 text figures illustrate the volume. Students of the subject, everywhere, will welcome the appearance of this important book. It will undoubtedly be a valuable work of reference for many years to come.

BIRD HOUSES AND HOW TO BUILD THEM. In view of the interest which is now being taken in the protection of our native insectivorous birds in various parts of Canada, the United States Department of Agriculture, Farmers' Bulletin No. 609, bearing the title, "Bird Houses and How to Build Them", will prove of much interest. This bulletin of 19 pages, prepared by Mr. Ned. Dearborn, Assistant Biologist, discusses briefly many forms of bird houses, nesting boxes, etc. Food shelters are also described. Forty-eight illustrations are given.

COMMISSION OF CONSERVATION; FIFTH ANNUAL REPORT. This very useful report was recently issued.

In his annual address, the Chairman of the Commission, Hon. Clifford Sifton, discusses the Commission's activities with respect to waters and water-powers, minerals, public health, agriculture, fisheries and fur-bearing animals and forests, indicating clearly and succinctly a number of the problems that had been grappled with and the advances that had been made in their solution.

Several articles appear in the report which are of special interest to naturalists. Mr. J. Walter Jones treats in detail of the progress in fur-farming in Canada during the past year. The work of the Committee on Fisheries was confined, during 1913, chiefly to the development of the oyster industry. Hon. A. E. Arsenault describes the new method of leasing oyster beds in Prince Edward Island. This method was advocated by the Commission two years ago, and will do much to regenerate the oyster industry in the Maritime Provinces. An exceedingly interesting paper on the "Protection of Migratory Birds" is given by a leading American authority, Mr. W. S. Haskell, who urges Canada to join with the United States in providing sanctuaries for these birds.

Considerable advance has been made in the conservation of forests during the year. The Commission has co-operated with the Board of Railway Commissioners and the several provincial and Federal forest services concerning the prevention of forest fires, with the result that much has been done to prevent forest fires along railway lines, especially in Western Canada. In addition to the report of the chief forester, Mr. Clyde Leavitt, there are addresses on forestry by Dr. B. E. Fernow and Mr. R. H. Campbell.

The report contains a number of splendid illustrations and gives in concise form much information that is of value to all Canadians interested in the conservation of our natural resources.

MEETING OF THE BOTANICAL BRANCH.

The Botanical Branch held the first of its bi-monthly winter meetings at the residence of Mr. R. B. Whyte, on Saturday evening, November 14. The meeting was in charge of Mr. W. T. Maçoun, Dr. M. O. Malte, and Mr. G. H. Clark. There were also present the following members: Messrs. Attwood, Ami, Buck, Criddle, Davis, Fryer, Gibson, Macmillan, Newman, Tully and the host, Mr. R. B. Whyte.

The subject dealt with was "Possibilities for Home Grown Seed in Canada" with particular reference to root and vegetable crops.

Mr. Macoun in opening the discussion stated that both Mr. Clark and Dr. Malte, as well as himself, had already given the subject considerable attention, having prepared articles, etc., for the press in which attention had been drawn to the point that there was a strong probability that shortages of certain seeds would be felt in Canada for at least the two following seasons, owing to the fact that Germany and France, the regular sources of supply, would not be able to fill orders as heretofore.

Summarizing the pros and cons of the case for Canadian grown seed, and other interesting points relating to the plants the seed of which, could or could not be grown to advantage, it was noted that (1) Home grown seed often produced more vigorous plants; (2) earlier fruits; (3) the suitability of localities for certain crops was an essential factor; (4) the question of the high cost of labour militated somewhat against home production; (5) about one dozen of the important plant families were represented by the most important of the popular garden and field vegetables; the asparagus and onion for instance, representing the Lily family; (6) nearly all of the present vegetables have been cultivated for a long time, and in some cases it was possible to trace modern species to a common origin. The modern cabbage, kale, and cauliflower were known to have come from one original type. Mr. Macoun in closing, again referred to the question of proper locality and stated that while he thought certain seed, like that of melons, might be produced most profitably in sections of the country, like British Columbia, yet he felt confident that in time most seeds now raised in Europe could be raised to advantage in Canada.

Dr. Malte dealt more particularly with forage roots such as mangels, turnips and sugar beets. He pointed out that the original wild form of such root crops consisted of a creeping form found on the sand of the coastal regions of Europe. This, without doubt, accounted for the fact that such crops possessed a liking for alkali soils and flourished in coast districts. In raising beet seed it must be kept in mind that different varieties cross fertilize very freely. Mangels too, in most cases were not yet fixed in types. When swedes and white turnips are grown side by side, it has been found that cross fertilization will influence the resultant roots, and that as a result many malformations of the roots follow. In some instances such malformations have been mistaken for the effect of Club Root, *Plasmodiophora brassicæ.*

From certain experiments which had been carried on at Yarmouth, N. S., it has been found that excellent seed of roots can be grown there. Eleven hundred pounds of seed per acre is about the average for mangels.

Mr. Clark discussed the methods adopted by the seedsmen in buying and distributing seed. He also stated how it was that seed-growing in such places as Waterloo County, Ontario, came to be started in Canada some years ago. It was a result of judicious help given by the federal Government. He further pointed out the fact that the sub-vention offered this year by the Government should help in the production of more home grown seed. The last few years over 1,200,000 pounds of mangel seed have been imported into this country, each year, much of which might be grown here. The subject provoked considerable discussion by the members.

F. E. B.

THE VALUE OF SOME MAMMALS AND BIRDS AS DESTROYERS OF NOXIOUS INSECTS.*

BY NORMAN CRIDDLE.

In these days of specialization, we are apt to overlook the close relationship that other classes or orders hold in the economies of nature. Yet, as our work proceeds we find that its scope must of necessity be widened to take in, at least, an elementary understanding of other things. The student, for instance of lepidoptera will find it necessary to learn something of botany so that he may recognize the various plants acting as unwilling hosts, or being fertilized through the agencies of the insects visiting them. He will also require some knowledge of hymenopterous insects and of diptera, which in their larval life sometimes live as uninvited guests within the caterpillars.

Then again, there are the birds and mammals which often play a not unimportant part in the control of insect outbreaks. As these last seldom receive their due in entomological journals, I have decided to select them for my theme, trusting that the outcome will not prove altogether without interest.

In the year 1913, being busily engaged in the task of collecting June beetles (*Lachnosterna* spp.) for breeding purposes, I had occasion to visit nightly a favourite locality for those insects, the time being from dusk to midnight. Here, lantern in hand, I examined the various trees for specimens and often sat watching the insects' habits, collecting such individuals as seemed desirable.

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*Contribution from the Entomological Branch, Department of Agriculture, Ottawa.

It was not long before I became aware that I was not alone in my searches, and soon it was discovered that another, equally keen in collecting and more expert in discovery, was keeping me company.

To begin with, this companion was only suspected by strange noises among the bushes, but one night hearing the usual snapping of twigs and characteristic *jump*, *jump*, among the leaves, approaching nearer, I waited silently out of sight, and then what should appear within a few feet, but a fully mature female skunk. She was startled, as I flashed the lantern light into her face, and made off, but afterwards, in the course of a few weeks we became more friendly, and I was privileged to watch her work. It was interesting too, to see how she jumped at the clumsy, buzzing beetles, either knocking them down with her front feet, or securing them before they had time to rise. Of course, I only saw her now and then, and that was generally while I was sitting or standing still, but I gained sufficient insight into her ways to see that she made a very fair meal of the beetles, and that without very much trouble. From the fact that she came back nightly, for several weeks, I fancy she too recognized the value of the vicinity as a collecting ground.

Later, when the beetles had vanished for the season, she still returned frequently. Now, however, paying all her attention to the grubs, which in searching for she seemed just as successful as she had previously been with their parents, though I was obliged to dig haphazardly to gain the same ends.

This was, by no means, my first experience with skunks as destroyers of insects, but I had never before watched one so closely in the field or realized how much good they could do. Since then I have had occasion to come into close contact with their work as destroyers of white grubs on a number of occasions, to say nothing of their love for grasshoppers, upon which they turn most of their attention during the summer months. As soon as the grasshopper season slackens, however, they return once more to the white grubs and continue feeding upon them until the insects, feeling that winter is approaching, make their way below the skunks' reach.

On a field near Aweme, Manitoba, badly infested with white grubs, two or more skunks were in the habit of visiting each evening to make their customary meal. One of them was probably my old friend, while the others doubtless constituted her family. I only saw odd individuals once or twice, but the evidence of their work was unmistakable. Here over an area approximating eight acres, were found little holes, without doubt the work of skunks. They usually only went to a depth of a few inches, but that was sufficient for the purpose. Making an estimate of the number of holes to a square yard, I found these to approximate slightly more than three. Supposing that each hole represented a white grub, and there is little doubt about this, then the total grubs destroyed, to an acre, would be 14,520. That is to say, 116,160 in the eight acres. To anyone not accustomed to skunks' habits, the discovery of white grubs under ground many seem questionable, but not to those who know, as a matter of fact these animals collect practically all their food by scent.

Naturally skunks, like many other animals, do some harm by eating useful insects, in fact they will even relish a *Calosoma* beetle. They also destroy some birds' eggs and occasionally raid a poultry house, but their value cannot, I think, be questioned.

Writing of white grubs reminds me of another enemy they have to contend against and that is our old and cheery friend the robin. In the east robins are industrious workers on our lawns, the food they seek there being largely earthworms. In Manitoba, however, and westward to the Rockies, earthworms are scarce, but in places at least, there are lots of white grubs, which though located below the ground are, as a rule, discovered with comparative ease by the robins. How they manage it I do not know, but that they do so I have seen demonstrated on a number of occasions, when a small flock made a badly infested field their daily feeding ground before the breeding season commenced.

Flickers and crows also rank high as white grub destroyers in late May. The former, however, do not trouble themselves so much about white grubs when other insects, such as grasshoppers and ants, are available.

It is, however, by following the plough and picking up the grubs exposed that the work of the crow ranks highest. In the open wooded districts preferred alike as breeding places by crows and June Beetles, one will often turn up the grubs in large numbers, but in my experience seldom in quantity too numerous for the birds following the plough. A flock of twenty-five or more crows following diligently behind in the furrow, have been my companions through many a day's ploughing in early summer, while in their company were the usual blackbirds and grackles, all occupied in the same task.

A little friend of mine, with, I am sorry to say, a bad name, is also very evident, I refer to the cowbird, with whom; in cheerful impudence, there are few to compare. They have no more fear of sitting upon an animal's back to pick off the flies than they have of running beneath one, or being shoved out of the way by its nose. As destroyers of grubs, they are excellent, but do not eat the larger ones when smaller are available, instead merely squeezing their heads as if desirous that they should be killed at all events.

These are the ploughman's more constant company, but occasionally he will have a graceful flock of gulls as his guests—voracious feeders upon every insect exposed, and a large flock will soon devour all specimens in sight.

In my personal experience, however, I have found crows to be by far the most persistent in their search for insects. They will literally live and feed their young upon cutworms from a badly infested locality, locating the grubs by means of the upheavals so characteristically left when one is working near the surface. Another favourite diet is made up of army-worms when present. During a local outbreak near my home, in 1913, I found that of all birds, crows were most in evidence at this time (August). As is well known, crows in autumn generally collect into large flocks, often of many thousands. One such flock, estimated at 3,000, visited the army-worms daily, particularly when they were crossing a road. Several infested fields were also located by the crows' guidance, the birds having forsaken all other food and flown several miles to partake of these caterpillars. The birds remained on the fields for some weeks after the larvæ had pupated, undoubtedly picking up these latter from beneath clods of earth, etc., which they are experts at turning over and habitually do so in search of insects. How many army-worms a flock of 3,000 crows would devour in two weeks, I will leave my readers to judge.

In describing some of the good qualities of crows, I do not wish it to be thought that I thus acquit them of all crimes. The crow is often a thief, helping himself to a farmer's corn, as readily as he will to eggs or young poultry when opportunity offers. To those of us who have watched his habits carefully, however, the good deeds seem to far outweigh the bad. And, therefore, I include him as an undoubted friend.

Another type of birds, frequently overlooked as destroyers of insects, but preserved at certain seasons on account of their food value and the sport they supply to hunters, are the various species of grouse.

To those who have lived in their breeding areas, it is noticeable that the yearly increase of Prairie Sharp-tailed Grouse (*Papediœcetes p. campestris*) in the prairie provinces fluctuates from year to year, the variation in numbers, apart from the devastation caused by gunners, being largely due to the food supply, the food in question consisting chiefly of grasshoppers.

Observation shows that an outbreak of locusts is nearly always followed by the successful maturing of a large number of young grouse. Hence, apart from the evidence acquired through the examination of stomachs, we are led to believe that the young subsist very largely upon such insects. They do not, however, by any means confine themselves to locusts. Caterpillars having smooth skin are consumed, from the largest sphinx larva, to cutworms, army-worms. etc.

As the season proceeds, however, the diet of the Sharp-tailed Grouse changes and while they still regard insects as luxuries, they now turn their attention to various grains, particularly wheat, which they occasionally damage to a small extent, though the damage as a rule does not extend over more than a month, while the injury itself consists of the birds resting upon the stooks and picking out the grains from the heads. By far the greatest portion of the grain eaten at this time, however, is gleaned from the ground, being waste material, and therefore of no value. This grouse is also troublesome sometimes before harvest, when it learns to break down the stems of grain to get at the heads. It is conceivable that if very numerous they might cause considerable damage by this habit, a contingency that does not seem likely to occur, however, under present conditions. They are also objected to occasionally by farmers through choosing one of their fields for a "dancing" ground in the spring months, when perhaps half a hundred males will collect for their morning and evening manœuvers, thoroughly trampling down an acre or more of land.

Of course, all there little depredations are insignificant when compared with the birds' usefulness as destroyers of noxious insects, and their value for food purposes.

The Pennated, or Square-tailed Grouse (*Tympanuchus americanus*) is another with habits very similar to those of the Sharp-tailed. It, however, chooses the open country for its home, whereas the latter prefers open woodlands.

The food habits of the Ruffed Grouse (*Bonasa* sp.) are much more in question than those of the species mentioned above, for while they undoubtedly devour many caterpillars and other noxious insects during summer time, they feed very largely upon buds in winter, often almost stripping trees, particularly those of poplar, besides badly damaging lilacs and other shrubs. It may be said, however, that the buds eaten are usually flowering ones which in poplars are larger than leaf buds, thus the trees suffer to a comparatively small extent. This argument cannot be used, however, in the case of lilacs, which should be protected by wire netting.

Naturally such injury is confined to the vicinity of wood lands which are the birds' natural homes. Probably the summer food taken fully compensates in value for the damage done in winter time, but more definite evidence is required to make sure. Of course, the bird is much relished as food and on this account alone is well worthy of being preserved.

There is one thing that may be said in regard to the status of birds as destroyers of insects. A great many useful insects are very minute and would thus escape detection. Others have stings or look so like bees or wasps as to readily pass for them. On the other hand a great many pests are large, such as orthoptera and lepidoptera and are thus more likely to attract attention. Of course a bird in seizing a grub may unwittingly destroy half a hundred parasites and so do harm, on the other hand it may go further and kill hyperparasites which prey upon true parasites.

There is no doubt that many bird lovers go too far in their claims of bird usefulness just as some entomologists go to the other extreme in minimizing their usefulness. As a matter of fact many of our worst pests are hardly influenced at all by birds. I may cite as an example the Hessian-fly, and other small insects. It is also generally a mistake to consider birds of first importance in the suppression of severe insect outbreaks. They doubtless help, the cases cited above beinga few examples, but they are far behind predaceous and parasitic insects in such work. Their aid, however, is far greater when pests exist in normal numbers. Then, by keeping them so, by picking off the surplus, they are accomplishing much in retaining the balance of nature.

NOTES ON THE QUAIL.

A reference to quail in Mr. Saunder's article in the October issue on bird preservation, noticed during an enforced confinement to the house, is responsible for these few items about the doings of a very gallant little gentleman. The remarks are only scientific in being accurate, but spending each winter on a club property of some hundred thousand acres in South Carolina, with a naturalist for a manager, a crowd of observant darky guides, and a changing group of guests, talking game and game habits every evening, *Colinus virginianus* has become a familiar friend.

Our American Quail, so called, is an Englishman in his courtesy to his woman kind, his bulldog fighting powers and his clinging to customs, that, in a new country with progressive neighbors, might well be changed. He takes his turn sitting on the eggs; if weather conditions are favorable to a second brood, fosters the first chicks until the two bevies unite into the families of twenty odd that sometimes gladden our eyes, and, it is said, should the better half be taken away, never remarries. A hen quail just outside the Oakland house fence was eaten by a rattlesnake. The cock remained there, single, two seasons, although charmers in quantity piped their notes a few hundred feet away.

An abundance of quail in a suitable country depends on four main factors—food, cover, water and, probably, grit. This last is important only in a delta section like Oaklands, where a morning search after a pebble for rasping a turkey call ended in breaking up a scythe stone; and food might perhaps be modified to winter food. Bevies with us do not break up before May, and they find then a plentitude of grass and insects everywhere. During the winter months in the south, quail live principally on pine mast, but lespedeza, "benny" wild helianthus, in fact any suitable sized weed seed, is acceptable

On plantations lately grazed by cattle, birds practically disappear—no cover.

Quail can stand a *short* cold spell, with snow, better than many other genera. They roost always in a close circle, heads out, in patches of low stubble, and remain there, dormant, until the weather improves or starvation scatters them.

Artificially increasing stock is a facinating but little understood subject. It is only within a year or so that hatching in confinement has succeeded at all. The mere dumping of unmated birds in pairs or quantity seems a waste of time. At Camden thousands of quail were imported from the west without permanent results, and we ourselves have often tried the thing on a smaller scale.

Beyond dispute, at the beginning of the breeding season, the strongest cock left by the sportsmen drives away all rivals, whistles a mate provided he is a young bird, and then, with the tenacity of the anglo-saxon, pre-empts such territory, be it one or twenty acres, as seems necessary for the welfare of his family, defending this while life lasts against all trespassers. The writer firmly believes that by judicious planting and observance of the other conditions, his majesty will be contented with merely enough land to secure happiness, leaving the extra room gained for new comers. But much better authorities say not, he wants what his father, grandfather, and great grandfather owned. Certainly at the Oakland Club we find, year after year, only the same bevies, though food has been provided, vermin trapped and a breeding stock carefully preserved.

What comes of the vast surplus thus driven away is an enigma. Quail are undoubtedly migratory in the small isotherms between northern and sub-temperate regions. Probably these southern birds drift north to fill the areas depleted by snow, but nobody knows.

It seems cruel to kill quail when so many less interesting and useful game birds exist, but the harder, in reason, land is shot over, the better. Otherwise the parent birds live to become barren, or one only of the original pair dies by accident. Districts that never see a gun, deteriorate and a single healthy young bird alive at the beginning of the mating season means a full sized brood at that place in the autumn. In Europe, however, eggs are taken from one nest to another, to provide change in blood.

Cats and cur dogs are the worst enemies. As farmers learn to appreciate the good birds do, it may become illegal to own or harbor pussy.

D. B.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, 1914.

SOME PERSONAL IMPRESSIONS.

To one who has not previously taken part in gatherings of that character, the meeting of the Entomological Society of Ontario held at Toronto, Nov. 5th and 6th, were of unusual interest. To begin with, there was the mixing with kindred spirits from all parts of the country, not forgetting our neighbors and co-workers from the south; for in the broad realms of science boundaries present little significance and those in its pursuit come as near to the ideal of universal brotherhood as any class I know of. This mixing, then, of men from all parts having similar aims, was by no means the least profitable of the proceedings and certainly not the least enjoyable.

To me, of course, many of the faces were new, though the men were in other ways old friends. It would be difficult to enlarge upon the characteristics or qualities of some without neglecting others equally worthy of note and yet it would be equally impossible to enumerate all in this short paper. I will, therefore, briefly touch upon a few picked out almost at random from those who were present.

Mention should first be made of our worthy President, Dr. Hewitt, who presided over the meetings, and whose presidential address, an exhaustive account of the rise and progress of Economic Entomology in Canada, was much appreciated by the audience. Dr. Bethune, an old and prized correspondent, and Dr. Fyles, another veteran, were present, the latter presenting a paper entitled "Mountains and Hills," written in his usual characteristic style and read in a manner which many of our younger generation might imitate to advantage. Prof. Comstock, fittingly described by our President as the father of modern entomology, delivered the public lecture, his subject being "The Habits of Spiders," and delighted his listeners by a magnificent collection of lantern slides displaying the web-spinning characters of various genera and species.

Prof. Lochhead, another old friend to all who have read the Annual Reports of the Society, enlivened the meetings by many a cheery remark, besides presenting us with matter of a more serious nature. An address that will long be remembered was his light touches and extracts from the works of the famous French naturalist Fabre. Professor Cæsar provided both papers and spontaneous material characteristic of the man and of undoubted value to the farming community. Among his contributions may be mentioned "An Imported Red Spider Attacking Fruit Trees" and "Cherry Fruit Flies"

Nor must I leave out my colleagues in the Entomological Branch, Messrs. Gibson and Swaine. The former's paper, entitled "Outbreak of the Army Worm in Canada in 1914", in which the writer depicted the insect's habits and showed that its depredation amounted to a loss approximating $300,000, was listened to with much interest, and in company with a paper by Mr. A. W. Baker, of the Ontario Agricultural College, entitled "The Army Worm in Ontario," was the prelude of a lively discussion.

Another paper by Mr. Gibson, entitled "Locust Control in Eastern Canada," was also of special interest to the writer of these notes.

Mr. Swaine's contribution on "Forest and Shade Tree Insects on the Farm," contained a special warning to citizens to be on the watch for pests now making their way towards our borders. He also gave an interesting talk upon Forest Insect Conditions in British Columbia.

In the discussion that followed the reading of all these papers, most of the members took part, and in this connection I would specially mention Prof. Crosby, of Cornell University, Prof. Brittain, of Truro, N.S., Father Leopold of Oka, and Messrs. Chapais, Dearness, Ross, King, and Hudson. The remarks of whom, together with the various papers, will appear in due course in the Annual Report of the Society, which should be in the hands of all interested in entomology.

Lastly, there was the smoker at our headquarters, of which only those who were present could form an adequate idea of its interest. Nor must I forget the hospitality of the Toronto branch who, headed by Dr. Walker, did much towards making the meetings a success. N.C.

THE OTTAWA FIELD NATURALISTS' CLUB.

PROGRAMME OF WINTER MEETINGS.

November 23rd, 1914, (Monday), open meeting. Exhibits and Addresses by Members. (Normal School Assembly Hall).

December 8th, 1914, (Tuesday). "The New Zealand Peripatus—The most ancient and wonderful of living animals." (Illustrated with living specimens). Prof. E. E. Prince, Dominion Commissioner of Fisheries, Ottawa. (Normal School Assembly Hall).

January 12th, 1915, (Tuesday). "The Royal Botanic Gardens, Kew." (Illustrated with lantern views). Prof. R. B. Thomson, Botanical Laboratory, University of Toronto. (Normal School Assembly Hall).

January 26, 1915, (Tuesday). "The Indians of the West Coast." (Illustrated with lantern views). Dr. Edward Sapir, Department of Anthropology, Geological Survey, Ottawa. (Normal School Assembly Hall).

February 9th, 1915, (Tuesday). "Fossils." (Illustrated with lantern views). Mr. L. D. Burling, Geological Survey, Ottawa. (Carnegie Library Assembly Hall).

February 23rd, 1915, (Tuesday). "Milk." (Illustrated with lantern views). Mr. J. H. Grisdale, Director Experimental Farm, Ottawa. Carnegie Library Assembly Hall).

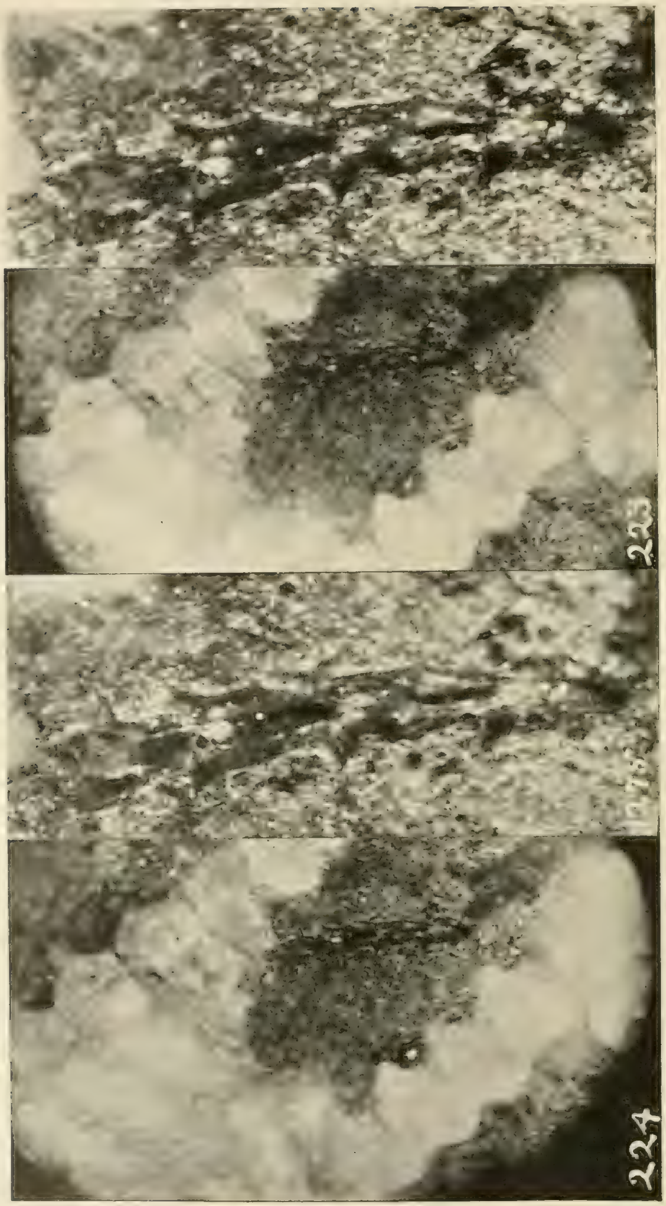
March 9th, 1915, (Tuesday). "Some Interesting Canadian Birds." (Illustrated with lantern views). Dr. M. Y. Williams, Geological Survey, Ottawa. (Carnegie Library Assembly Hall).

March 23rd, 1915, (Tuesday). Annual Meeting and Presidential Address, "The Habits of Insects in Relation to their Control." Mr. Arthur Gibson, Entomological Branch, Department of Agriculture, Ottawa. (Carnegie Library Assembly Hall).

Meetings commence at 8 p.m.

HARLAN I. SMITH,
Chairman Lectures Committee.

12. —



CERAMOGRAPTUS RUEDEMANNI, HUDSON.

Left figure in each half of stereogram x 20 dia. and from a mounting under gum,—right figure an enlargement from same negatives to 60 dia. The plate numbers are those of the original negatives.

THE OTTAWA NATURALIST

VOL. XXVIII JANUARY, 1915. No. 10.

CERAMOGRAPTUS RUEDEMANNI

A New Genus and Species of Graptolitoidea, and Notes on Urasterella pulchella, Billings. Plate II.

BY GEORGE H. HUDSON.

The holotype of this species is the fragment of a rhabdsome lying across the weathered base of an arm of the holotype of *Urasterella pulchella*, Billings, in the Victoria Memorial Museum, Ottawa, Canada. Horizon—Trenton at Ottawa, Canada.

This species seems allied to *Cactograptus*, Ruedemann, but the difference in form and arrangement of the denticles entitles it to generic distinction. Until new material is discovered the diagnosis of the genotype must answer for that of the genus.

Ceramograptus ruedemanni, sp. nov.

The branch measured across from apparent spine tips of oppositely placed denticles is 0.26 mm. wide. The denticles are 0.37 mm. long, placed nearly parallel with the main axis, and but slightly overlapping. The lower half of the outer margin of each denticle makes an angle of about 21 degrees with the axis of the branch. The middle is gently convex and on this ventricose portion there seems to be a short angular or spiny process. The upper half of this marginal line is at first slightly concave and subparallel with the axis but soon swings out in a graceful curve to the point of a short apertural spine. The apertural opening is slightly concave and from the tip inward measures 0.08 mm. in diameter. These margins appear to be slightly thickened or keeled and the apertural margin near the axis is slightly folded or vertically ribbed, presenting three short ridges which have strongly reflected the light and appear as white spots in the photo-micrographs from which our plate was made. The appearance of these denticles is that of slender and graceful vases with a pouring lip, each vase set with its back to the main axis. Hence the generic name from *Ceramos*, a pitcher or vase.

A study of this plate with a stereoscope seems to show that the denticles were arranged in double pairs, *i. e.*, with four denticles arising from each node. In the lowest group there seems to be a denticle occupying a middle position between the pair at the sides, but its apertural margin and parts of its ventral surface are lost. In the next group above, the gum mounting allows us to look deeply within the branch and see (from the inside) the ventricose portion of a denticle on the distant side of the axis. Above this opening there remains a portion of a denticle facing the observer. The next group above also shows portions of a third denticle. The fourth or topmost group has been cut across diagonally by weathering. The openings on this surface present additional evidence that each node bore, at least, four denticles.

The plate shows clearly the value of mounting with gum damar, for such mounting not only served to render the surface more transparent and increase the contrast between the black remains of the chitin and the matrix, but it also aided in securing that sharpness of outline which still appears in the subsequent enlargement to 60 diameters.

The specimen is named in honor of Dr. Rudolf Ruedemann, to whom the writer, and the world as well, is deeply indebted for his work on this interesting group of fossil organisms.

The detail of *Urasterella pulchella*, Bill., which is reproduced on this plate, shows some of the flooring ossicles (ambulacra) of the arm, a number of arm marginals with spine bases, and an apparently double interradial marginal. The ambulacral plates, here lost, are elsewhere present and functioned as true covering plates. That is they could be closed so as to meet each other over the food groove or they could be held in a widely open condition and the five interradial pairs could function as jaws. More complete details of this species will be given in another article.

THE BANDED POCKET MOUSE, *PEROGNATHUS FASCIATUS* WIED.

By Stuart Criddle, Treesbank, Man.

The mouse forming the title of this paper was discovered and described by Maximilian, Prince of Wied, in 1839. It was collected on the upper Missouri river near the mouth of the Yellowstone, North Dakota , and proved to be a new genus as well as a new species. It was, also, the first pocket mouse to be found in North America. Since the original discovery of pocket mice on this continent, however, the number of known species has increased rapidly. In 1889, Merriam* described no less than twenty-one species and sub-species while since then, and up to the publication of Miller's List† the total number of recognized kinds has increased to eighty. Most of these species, however, occur south of the Canadian boundary, and so far as known to me, but two have been taken north of latitude 49°. One of these, *Perognathus lordi* Bird, is a native of southern British Columbia, the other, *P. fasciatus*, probably occurs over much of the territory of southern Manitoba, Saskatchewan and Alberta, but as yet, has only been recognized in the neighbourhood of the writer's home, where it was first recorded several years ago. Since the time of its original discovery in Manitoba, and up to about three years ago, this pocket mouse was comparatively rare, but of late it has greatly increased in numbers and can be said to be moderately common at the present time. So far as I can see the Manitoba examples seem to be considerably lighter in colour than the type which is described as between an olive-green and an olive-gray above. In my specimens the hairs are a light slaty-gray at their bases, fading to a light tawny colour higher up, and are tipped with black, these black tips, however, giving place to light tawny or pinkish along the sides, forming an indistinct band from which the animal gets its name. Below, the hairs are entirely white. The measurements of six specimens are as follows: three males; average length, 129 mm., tail 56 mm., hind foot 17 mm.; three females; average length, 126 mm., tail 56 mm., hind foot, 17 mm. Dr. Merriam, in the publication before mentioned, gives the total length of one specimen as 136 mm., so that typical specimens are somewhat larger than the Manitoba examples. As apparently no information of the animal's habits are available, the following, from my own experience, may prove of interest.

The young are born about the middle of May. In the only instance of which I have record the number of young were four. As the female has but six teats, four young would probably be an average litter. Taking into consideration the various habits, such as the early storage of food and retirement below the ground and also the fact that all the young appear to be fully developed by the first of October, I am convinced that but one litter is produced yearly.

In their general habits these pocket mice are solitary, never gregarious, in consequence seldom more than one or two are met with at a time, either above or below the ground. They seem to have a preference for sandy soils in which to construct their homes, but sometimes wander far afield in their search for food.

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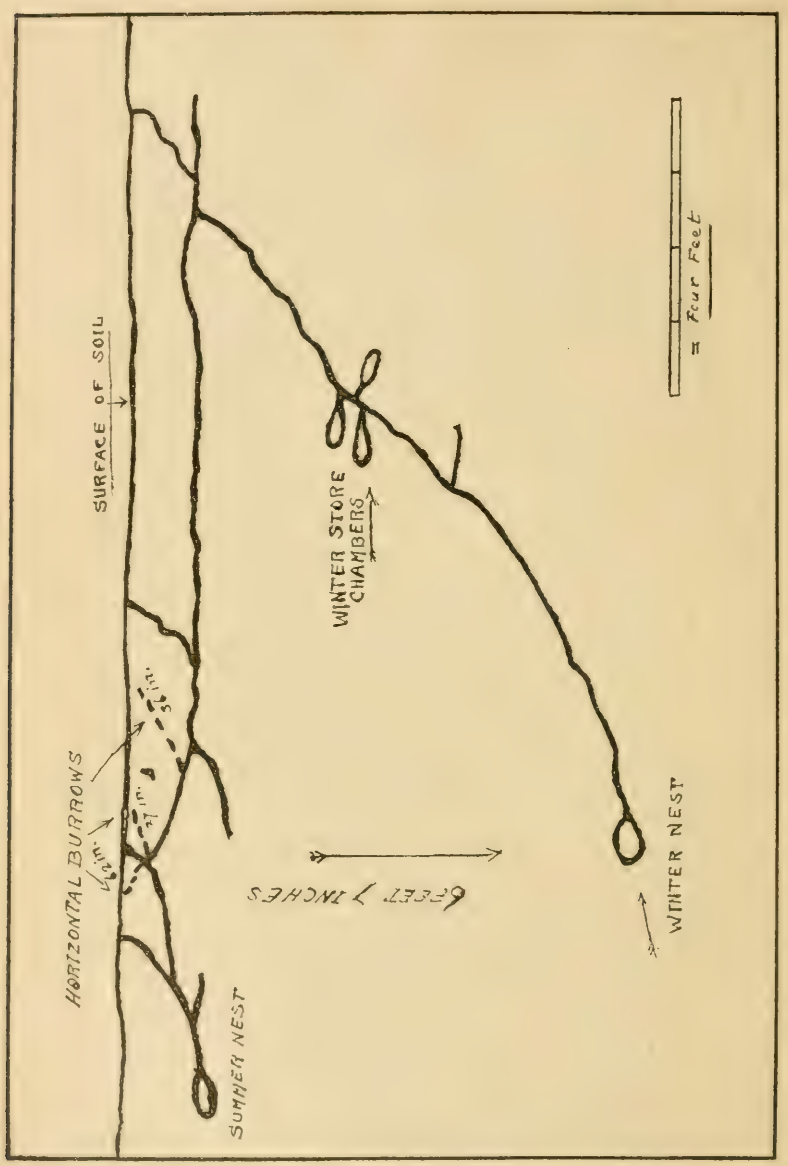
*N. A. Fauna No. 1, U.S. Dept. Agr., 1889.

†N. A. Land Mammals, U.S. N.M., 1911.


SURFACE OF SOIL
WINTER STORE CHAMBERS
= Four Feet
HORIZONTAL BURROWS
6½ in.
2½ in.
3½ in.
6 FEET 7 INCHES
SUMMER NEST
WINTER NEST

Showing Burrows of the Banded Pocket Mouse, (original).

The habitations consist of a number of burrows, many of them running close to the surface, and often extending over an area of, at least, 20 feet across. From these burrows there may be several entrances or exits, as the case may be, as well as numerous blind runways. One burrow somewhat deeper than the rest is enlarged at its lower extremity to form a summer resting place. All these burrows twist about in a most intricate manner, and, as a rule, have their entrances hidden in a clump of weeds or grass, well away from the piles of sand thrown out in excavating.

At the approach of winter the pocket mouse becomes still more industrious. Two or more chambers are constructed at a depth of about three feet and in these are stored various seeds for winter use. Then having finished the task of providing food, the burrows above the stores are tightly closed from below and a much deeper hole commenced, which is doubtless intended to take the mouse below the frost line. At the end of this burrow, which is about six and a half feet below the surface, a winter home is constructed by digging out an enlarged chamber and lining it with a scanty supply of Green Foxtail heads. In this home the pocket mouse passes the winter, probably much of it in sleep, as those kept in captivity became very sluggish when exposed to even a moderately cold atmosphere.

The method of constructing a winter home, after the mouse has retired for the winter, wants confirming. As further evidence, however, to indicate that the winter home is constructed in the manner described above, I may mention an instance in which I dug out a burrow in late October before the mouse had retired, when no burrow occurred below the store chambers, though just above them was the material that would afterwards form the winter nest. Thus there is every reason to believe that the mouse gathers all that is necessary, in the form of food and nest-making material before winter commences and constructs the true winter home after retiring from above ground for the winter.

A remarkable fact about the two fully constructed burrows dug out on November 10th, was the finding of a dead pocket mouse at the entrance of the lower store chamber in each instance, the dead animal being presumably the owner of the home. Both these mice had been dead several days and each had a hole eaten in its head, and the brains extracted. Both these mice were males. Thinking that perhaps a female, or whatever the kind of animal was that killed them, might be hiding in an unobserved chamber, I made a very careful search for any hidden hole, but without avail. I am still of opinion, however, that there must have been some hidden burrow that I failed to find, in which the slayer was concealed. At this time the ground was frozen to a depth of six inches and all exits were closed. Of the three winter stores examined, No. 1 contained about three-quarters of a pint of the following seeds: Green Foxtail, *Setaria viridis*, 66 per cent.; Bugseed, *Corispermum hyssopifolium*, 34 per cent., both plants being abundant in the vicinity. Nos. 2 and 3 were close together and contained in all about the same quantity of seeds as No. 1, made up of Wild Buckwheat, *Polygonum convolvulus*, 48 per cent., *Panicum wilcoxianum*, 30 per cent., Blue-eyed Grass, *Sisyrinchium angustifolium*, 4 per cent., and *Lithospermum angustifolium*, 18 per cent. Green Foxtail, Wild Buckwheat and Bugseed are all weeds, the first two causing much loss to farmers by starving out various crops, while the other three are wild prairie plants of small economic significance.

None of the cultivated seeds occurred in these mouse's homes, nor in their pockets, but I have twice discovered locust eggs in the latter and have besides, observed many places where locust eggs had evidently been dug out of the ground. As a matter of fact, I believe that further evidence will show that these pocket mice live very largely upon insects during ths summer months. One I kept in captivity preferred meal worms, (*Tenebrio molitor*) to any seeds, but when the latter were alone available it selected Green Foxtail and Wild Buckwheat in preference to cereals, Lamb's Quarters, Redroot, Tumble Weed and *Cycloloma*.

From the evidence depicted above it would seem that the Banded Pocket Mouse does little harm, while on the other hand the consumption of weed seeds, combined with the destruction of noxious insects speaks wholly in the mouse's favour. It would appear, therefore, that unlike most rodents, we have here an example that is useful and it is a pleasure to me to believe that this pretty little animal is worthy of protection.

THE NEW ZEALAND PERIPATUS.

BY PROFESSOR EDWARD E. PRINCE,
Dominion Commissioner of Fisheries, Ottawa.

During my recent visit to New Zealand for the purpose of making an official survey of the fishery resources of that Dominion, I spent a day in the dense, almost tropical forest, so characteristic of beautiful Maoriland, with the object of seeing, in its native haunts, that wonderful yet insignificant little creature, *Peripatus*, about which almost a whole library of memoirs and books has been written, and upon the study of which animal, several great scientific reputations have been largely built. Francis Balfour, H. N. Moseley, Adam Sedgwick, and others no less eminent, owed much of their fame to researches on *Peripatus*. Yet, few zoologists have ever seen *Peripatus* "at home", and I believe that I am the first to bring living specimens to Canada. I had many memorable experiences in New Zealand; but I count it one of the greatest privileges of my life to have seen this "very beautiful looking animal" (as Dr. Arthur Shipley rightly styled it) creeping about in the moss-grown decaying logs of the primeval forest, amidst giant gum-trees, great tree ferns, and tangled creepers. Professor Kirk, of the University of New Zealand, Wellington, N.Z., kindly took me to the "hunting grounds", not far from Parirua Harbour, on the coast north-west of the capital city. With Dr. Kirk's experienced help I secured about a dozen specimens, varying in size from 2 inches up to about 3 inches in length. I kept them in a small vivarium which was maintained in a cool and damp state by sprinkling the moss and pieces of wood daily with water. The war conditions on the Pacific delayed my return so seriously that my specimens were confined in their close quarters for over 10 weeks, and many were quite moribund by the time I reached Winnipeg, in the last week of October. During their long journey of over 14,000 miles by sea and land they did well, in spite of the constant noise and vibration on steamers and cars, and they fed readily upon flies and particles of raw beef. A number of young about ¾-inch in length, were produced viviparously on the journey. During the last stages of my homeward journey I forebore turning them out of their mossy hiding place, and I fear that none actually survived until I reached Ottawa. All were, unfortunataly, dead when I examined the vivarium just before the meeting of the Ottawa Field-Naturalists' Club on December 8th.

As Professor Moseley said, *Peripatus* resembles a black caterpillar, with a pair of anterior antennæ, like the mobile horns of a snail. Some of my specimens were of a deep velvety brown, not velvety black, and they are such soft, elastic creatures that they are able to stretch almost double their usual length. If touched they shorten and pull in their antennæ, and if they fall over, they writhe back, bit by bit, and regain their feet (17 pairs in *P. novæ zealandiæ*) and glide off rapidly with a most graceful movement, waving the antennæ from side to side. On exposure to light they hasten, like slow-moving shadows, to the nearest shelter, and hide away. They are very soft and sensitive and easily injured by handling, or by pressure. I was surprised at the rapidity with which they discovered house-flies placed alive in their box. Within a very short time I always noticed such flies either glued to the side of the box or the glass-lid, or creeping slowly with wings or legs glued together. On touching *Peripatus* it usually shoots out a delicate spray of gummy material from two apertures on the pair of oral papillæ under the head. This gum or slime is so tenacious that it is difficult to remove from the hand, and one of its uses is to capture active prey like flies, etc.

Why is it that *Peripatus* is of such surpassing interest that Professor Moseley declared it to be an animal of great antiquity and my friend Dr. Shipley, Master of Christ's College, Cambridge, pronounced it "one of the most interesting animals known," from a morphologist's standpoint?

Its distribution indicates its ancientness. It is nowhere very abundant, but it occurs in New Zealand, Australia, the Cape, South America, St. Thomas and the West Indies, Panama and possibly Sumatra. To the naturalist such a sparse but widespread distribution means that it is a dying type, once abundant and of former wide occurrence. But it is a stem form, or connecting link, and just the kind of animal so rare, and yet so eagerly looked for by the evolutionist. It seems to be the very form from which the two vast animal Phyla, the Annulata and the Tracheata, have sprung. Nay, even the Echinodermata and the Mollusca seem to have features which they may have derived from *Peripatus*; and forms like the ancient Crinoids and the Xiphosuran, *Limulus*, or King-crab, though so ancient, possess features less ancient and more specialized than *Peripatus*. Its archaic generalized features are so many and so striking that it is impossible to treat them adequately in this brief note. To refer only to two salient points, it may be mentioned that the Echinoderms, though radiate, have essentially a right and left half in the form of the body; and in larval stages the symmetry of the body is most strikingly bilateral: but this is disguised later by the radial arrangement of parts. In the King-crab the compound eye is not a primitive feature, and the presence of internal skeletal elements (endosternite) a complete capillary system in the blood-vascular arrangements, the specialized nephridium, or kidney, in the shape of the coxal gland with attached lobes, and the massed nervous system (brain, oesophageal collar and reduced ventral cord) are all far less primitive than the annulate *Peripatus*. Indeed as one facetious observer says, *Limulus* must be later than the Annulates, for it fed upon them, the food of the King-crab being various marine annelids. *Peripatus* is an annulate in many features, being like a chætopod or worm in its cylindrical, bilaterally symmetrical, body, its anterior nerve ring and pair of widely separated ventral nerve cords, without serial ganglia, and especially in the paired sympathetic nerves on the pharynx and œsophagus, the pharynx being markedly muscular. The simple eyes (one pair), the numerous paired segmental organs or nephridia, of which the outer and the internal vesicle are really cœlomic, while the first pair become the large salivary glands, as in some Oligochætes; the short stomodæum and proctodæum (or anterior and posterior sections of the alimentary canal), the hollow, sac-like limbs, and the soft, delicate integument, without a dense, hard exoskeleton and the presence of cilia are all worm features.* But *Peripatus* is also a Tracheate, for like insects it breathes by tracheal tubes opening by external stigmata, its limbs show slight segmentation and some are modified as mouth-organs, it has antennæ, and the heart and the generative organs are cœlomic, the ova and sperms being derived from the walls of the cœlom. All these features are in contrast to the Annulates and connect *Peripatus* with the Tracheates, and therefore the Insects. "I believe it to be," said Moseley, "a nearly related representative of the ancestor of all air-breathing Arthropoda *i.e.*, of all insects, spiders and myriapods. It is impossible here to consider the profoundly interesting nature of the body-chamber, which is a hæmocœl, and not a cœlom or true body-cavity at all, certain portions of the true cœlom alone persisting as in the segmental or nephridial spaces, and the generative glands. The study of *Peripatus* throws a flood of light upon the origin of many of the most important features in the Tracheates, it is indeed *the* Prototracheate and forms an entire class to itself, a class with one genus only. But on the other hand it is an Annulate and has features in common with Molluscs and Echnoderms. There is probably no more generalized type of animal living and it may be justifiably maintained that it is therefore the most interesting and possibly the most ancient of metazoan stem-forms. If *Peripatus* preceded the Annulates and Tracheates and was the ancestor of all the worms, insects, spiders and myriapods, why have we not some fossil remains in some of the early fossiliferous strata? *Peripatus* is such a frail, soft creature that excepting for the hard jaws with four sickle-shaped cutting blades; the chitinous jaw-levers or so-called buccal tracheal pits, first correctly described and interpreted by Dr. C. Gordon Hewitt; the minute occelli or simple eyes, the chitinous claws, minute external spines and the tracheal tubes, no remains could be readily preserved permanently, and the structures referred to are too insignificant to be easily discerned in the rocks, if they have been preserved. Moseley went so far as to say that were the foot-jaws only larger they would, no doubt, occur in strata as old as the "Old Red Sandstone." Phylogeny or the study of the pedigrees of animal types, has available no generalized stem-form more interesting than the Prototracheate *Peripatus*.

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*The two muscular layers, circular and longitudinal and unstriped, are worm features; the fibres of the jaw-muscles are, however, striped (see Dr. C. Gordon Hewitt "Buccal Pits of Peripatus" Proc. Manchester Lit. and Philos. Soc., Vol. 50, Oct. 21, 1905).

A NOTE ON THE COLOURS OF TUMBLING MUSTARD SEED.

To those of us who have had to do with the seeds of Tumbling Mustard (*Sisymbrium altissemum*) it is well known that these are nearly always met with in mixtures of two distinct colours, one kind being light-yellow, and the other dark-greenish. As a rule the latter predominate to the extent of about three to one, but occasionally the proportions are the other way about, while still more rarely one colour may entirely dominate. Two or more instances of the last condition were brought to my attention during the winter of 1913, while I was with the Dominion Seed Branch, at Ottawa. In these cases, samples of flax harvested in Saskatchewan contained light coloured Tumbling Mustard Seeds only, their purity being so unusual that some doubt was thrown upon the authenticity of the determination, thoug the seeds did not differ in other respects. The only objection being, therefore, that they were all of one colour instead of being mixed.

During the autumn of 1914, my brother Stuart had occasion to collect a quantity of Tumbling Mustard seed, and in doing so visited a situation where the species had only recently become established, probably not more than four or five years. By that time, however, the plants had spread over a considerable area and were sufficiently numerous to provide more than a pint of seed. On examining the seed thus collected, it was at once observed that all were of the light yellow variety, thus establishing the fact that they had evidently bred true to type, and were therefore a distinct strain.

This at once led to further investigation, and it was then discovered that both colours were never met with together on individual plants, but that one plant would produce only yellow seeds and another only greenish . We have as yet found no exception to this rule though plants of both types are frequently met with growing side by side; in fact, they are seldom found otherwise, which would, of course, account for the two kinds being nearly always mixed in samples of cultivated seeds.

As the plants producing both kind of seeds are generally growing together and are moreover visited by various insects, particularly bees, it must naturally be supposed that they are readily cross-fertilized. It is, therefore, interesting to know that this crossing does not apparently affect the colour of the seeds on individual plants, which are still either all yellow or all greenish.

No attempt has been made to breed the plants to ascertain whether the resulting seeds confirm to the usual Mendelian law, when yellow and green producing seed plants are crossed, though doubtless this is the case.

NORMAN CRIDDLE.

MEETING OF THE BOTANICAL BRANCH.

Held December 19th, at the home of Mr. G. H. Clark, 501 O'Connor Street. Dr. M. O. Malte had charge of the meeting and exhibited many fine specimens of Canadian grasses, a collection of which he is preparing for exhibition at the Panama-Pacific Exhibition at San Francisco in 1915.

The remarks of Dr. Malte dealt with "Climatic and Soil Conditions as they influence Plant Life." Many of the specimens which he exhibited demonstrated in a very forceful manner how extremely powerful such influences are. It was stated that during the four months of collecting during the past summer he had brought together about two hundred distinct species of grasses. Of these about one hundred and seventy were native to Canada. The other thirty odd were probably originally imported from Europe, but could be now found wild in many places in Canada. These European grasses, he stated, did exceptionally well in the coastal regions, such as those of Nova Scotia and British Columbia. In this connection, he exhibited and discussed the awnless Italian Rye grass of which about fifty distinct forms could be found. Such forms being to a large extent the result of climatic and soil conditions. Moreover, the influence of such conditions also accounted for the fact that while this particular grass was an annual at Ottawa, in other parts of the Dominion it took on a biennial form, while in British Columbia, it became a true perennial. His remarks in this connection, that is, as to why a plant changed its seasonal habits, provoked some interesting remarks from other members of the club, who held different opinions on this point. This grass, he said, had been known to yield as high as eighteen tons to the acre, where the area it occupied had been irrigated by flooding it from a city sewerage system.

An interesting fact mentioned was, that out of the two hundred species he had collected, not more than from six to ten were of any commercial value. This was largely due to the fact that many wild grasses are bunchy, produce few leaves, and their seed cannot be profitably harvested. The varieties which had the greatest value were those related to the Western Rye grass, and to Kentucky and Canadian Blue grasses. He thought that about fifty more species might yet be collected in Canada, making a total of some two hundred and fifty species independent of the varietal forms of such species.

The value of having such a collection of grasses, and having one set of the same splendidly mounted in a rather striking manner for exhibition at Panama, was emphasized. In 1898, the late Dr. Fletcher, Dr. Malte said, made one of the first collections of grasses ever made in Canada and these grasses were grown at the Central Experimental Farm. The purpose of the two collections were somewhat different, however, with the former the purpose was to find out species useful for Canada. The work at present dealt also with the systematic botany and biology of native grasses. Foreign countries, even to-day, thought of scientific work along such lines as being unknown in Canada, and hence the exhibition of such a collection at Panama would do much to align Canada with other countries as one in the van in the matter of profitable scientific research, in the field of applied botany, etc. The collection would be subsequently used at many of the Provincial Fairs. All specimens are to be clearly labelled in both Latin and English. The collection at Panama will occupy eight hundred square feet of wall space.

In the matter of drying the collection demonstrated the skill of the collector. Each specimen was changed twice within the first twelve hours after collecting. Strong felt paper was used for the drying process. Dr. Malte mentioned his indebtedness to the Messrs. Criddle and Mr. W. Herriot for help in making the collection.

Those present at this meeting of the club were: Messrs. Attwood, Blackader, Buck, Campbell, Clark, Criddle, Dymond Fryer, Honeyman, LeLacheur, Macoun, Macmillan, Tulley and Whyte.

F. E. B.

DR. JOHAN HJORT ON "NORSE FISHERIES".

The Ottawa Field-Naturalists' Club has rarely been favoured with a scientific address more original and fascinating than that on the "Fisheries of Norway" by one of the most eminent of

European experts and scientists, Dr. Hjort, Director of Norwegian Fisheries, Christiania.

Dr. Hjort, who speaks very perfect English, illustrated his remarks by a fine series of stereopticon views, including Norwegian coast scenery, fishing fleets, catches of fish, and charts and diagrams. He began by showing how the quaint fishing boats of the ancient Viking type have been replaced by decked vessels, and later by large steam "drifters". Fishermen had, said Dr. Hjort, a general idea as to the dates, each season, when schools of herring and other fish appeared, and the grounds usually frequented by them. But there was always uncertainty and the varying abundance or scarcity of fish were regarded as a mystery. The causes were unexplained. To remove this uncertainty scientific researches of a systematic nature were commenced 12 or 15 years ago. The result has been that the causes of the fluctuations has in many ways been determined, the migrations and resorts of the fish ascertained, and a number of splendid new fishing areas discovered.

By means of townets, the floating eggs of fishes like the cod, haddock, torsk, and ling, and the myrials of surface-haunting young fry, have been captured in varying quantities. It was found that the number of eggs and young fish, per square metre of water, most accurately indicated the quantity of adult fish in the deeper waters below. If 4,000 eggs were counted, in one square metre, in one locality, and only forty eggs in one square metre in another locality, the fish were approximately ten times more plentiful in the former locality. This quantitative method has proved most reliable. Vast numbers of eggs and fry were taken in localities, not regarded by the fishermen as good fishing grounds; but on operating there these new fishing areas yielded great catches.

The study of the races, and what are called "year classes", as well as the discovery of the age of fish by the means of rings of growth on the scales, had given most valuable and striking results. By using "drift nets" of various meshes herring, for example, had been obtained showing great differences. The herring of Norway, on the whole, is a larger fish, at the same age, than the Scottish and English herring, and there was practically no intermingling, a diagonal line drawn from a point east of the Farœs down to the middle of the North Sea, separating the two race types. But local varieties also occurred. Large herring, fat herring and small herring, as experience showed, occur with great regularity. Thus from January to April, large spawners occur off the south-west coast of Norway, whereas a little further north such large herring occur from October to January. Fat, immature herring and small herring abound along the whole coast, increasing towards the north (Nordland and Tromso). Study of the scales proves that the large and spawning herring are four to eight years old, some being even sixteen to eighteen years old, while the "fat" herring, as Professor G. O. Sars long ago opined, are two to four years old, some being one year, while others are six to seven years old. To determine the age-composition of the whole herring tribe along the Norse coasts, the proportions of small, of fat, of large and of spring herring would require to be ascertained, but science has found a far more neady and easy way. Dr. Hjort stated that 15,000 examples of herring had been carefully examined in one year (1910), and it was found that in successive years, the fish of one year predominated. Thus the herring hatched, in 1904, exceeded other year-classes, in 1907 (as three-year olds), in 1908 (as four-year-olds): but in 1909 and 1910, they formed a less predominant portion of the "fat" herring schools: because they had joined the large and spring herring schools and could still be identified by their scales. Indeed in 1911, they formed, as seven-year-olds, 70% of the large herring schools. 1904 must have been a more favourable year, for the herring spawning and hatching, than the years before and after. The 1899 year class, being eight-year-olds, in 1907, were traced through 1907, 1908 and 1909 among both the large herring and the spring herring, and were far more abundant than the older and younger year-classes in the same schools.

These researches have shown that it is possible to ascertain how numerous the year classes are in relation to each other in successive years, if the specimens be sufficiently numerous to be representative. The schools live under such diverse conditions in the waters from 58° to 71° North Latitude, that the rate of growth locally differs. The growth each year being shown by the rings upon the scales, a broad ring means rapid, favourable growth, a narrow ring means less favourable growth, and local races are recognized by special year rings, either broad or narrow. 1904 herring taken in 1909 show five rings, the first, second and third year rings being fairly equal: but the fourth and fifth are very narrow in some samples: but in others, the third-year ring is narrow. Thus these two types (representing local schools) of the same year can be recognized with facility. The latter are of "Nordland" origin, and migrated south to join the southern 1904 schools, of which they formed 26%. Results of a similar character are shown by the study of the cod, the age and local origin being shown by the study of the scales, and a key is thus afforded to the growth, migration and distribution of valuable food fish.

At the close, Professor Prince proposed a vote of thansk appreciatory of the treat Dr. Hjort's lecture afforded, and he expressed the hope that Dr. Hjort would be able to continue his work in Canada for another year. Dr. C. Gordon Hewitt seconded the motion and pointed out that an illimitable market for fish food would arise as a consequence of the present war, and Canada should prepare to supply the vast demand that would arise. Professor Macallum, of Toronto, added a few words of commendation, and the President (Mr. Arthur Gibson), in putting the motion added his own appreciation of Dr. Hjort's valuable address. The stereopticon, it may be added, was skilfully operated by Mr. J. S. Harterre.

E. E. P.

NOTES ON THE PREPARATORY STAGES OF *PROSERPINUS FLAVOFASCIATA ULALUME* STRH.*

By ARTHUR GIBSON.

In 1905, eggs of this sphingid moth were received from Mr. J. W. Cockle, of Kaslo, B.C. Oviposition took place at Kaslo, on May 30, and the eggs hatched at Ottawa, on June 12. In 1904, Dr. Dyar published† descriptions of the egg and the five larval stages. My notes agree on the whole with such descriptions, but as further information is given on certain points, it seems excusable to present them in their entirety. They are as follows:

Egg.—Elliptical in shape, size 1.2 mm. by 1 mm. by 1 mm.; pale green, shining, smooth; length of egg state as above indicated 12 days. In 1910, a female of *ulalume* was received from Agassiz, B.C. During the journey to Ottawa, seven eggs were laid. These hatched on May 25, but unfortunately the larvæ died soon afterwards.

Stage I.—Length at first 4 mm. Head pale greenish, mandibles brownish. Body pale greenish, cylindrical, plump; segments of body wrinkled (8 wrinkles); no markings on body. Caudal horn 0.5 mm. long, pale at base, darkened towards and at tip. Feet concolorous with body.

Most of the specimens moulted on June 16 and 17.

Stage II.—Length 8 mm. Head slightly bilobed, with a yellowish tinge; ocelli black. Whole body washed with white, giving the larva a glaucous-green appearance. Dorsal vessel showing down the centre of the dorsum as a narrow dark line, from the head to the base of the horn. Subdorsal stripe white, conspicuous, narrowly margined above with yellowish-green. Horn black, like body washed with white. Spiracles very small, dark, in a pale ring. Thoracic feet and proleg concolorous with body.

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*Contribution from the Entomological Branch, Department of Agriculture, Ottawa.

†Proc. U.S.N.M., XXVII, 790.

Three specimens moulted the second time on June 19.

Stage III.—Length 17 mm. Head rounded, slightly bilobed. Whole body pruinose, as though powdered with flour. Dorsal vessel inconspicuous. Subdorsal stripe white, broadly margined above with clear green. Caudal horn nearly 2 mm. in length, black, reddish at base, lined with black in front. Spiracles pale yellowish, inconspicuous.. Feet concolorous with head.

Two specimens passed third moult on June 21.

Stage IV.—Length 23 mm. Almost the same as Stage III. Head 2.5 mm. wide. Body pale green thickly dotted with white, pruinose as before—a bluish-glaucous shade. Dorsal vessel hardly distinguisable. Subdorsal stripe clear white bordered above with dark green, almost as wide as the white stripe. Caudal horn 3 mm. long from front edge to tip, very wide at base, the upper half black, the lower half about equally divided in colours, yellowish-white at the base and above ringed with orange; ornamented in front with a black rather oval-shaped spot, the whole base of horn being broadly ringed with black. On segments 5 to 13 inclusive is a medio-ventral series of dark gray, almost black, elongated blotches, one in the middle of each segment. Spiracles yellow, very narrowly ringed with black. Feet paler than body.

Larvæ moulted for the fourth time on June 27 and 28.

Stage V.—Length 33 mm. Head 3.8 mm. wide, rounded, slightly bilobed, blackish-brown, clypeus rather paler; mouth parts pale yellowish-white. Body blackish-brown, bearing innumerable small black dots, particularly on sides and dorsum. A series of much larger subdorsal spots are also present on segments 3 to 11 inclusive. Midway between these latter spots and the spiracles is a rather indistinct, broken, black band more apparent on the middle and posterior segments. A rather inconspicuous dorsal stripe is also present. Spiracles bright and conspicuous, yellow-ochre rimmed with black. Caudal horn much reduced, now being a blunt wart-like elevation about 0.5 mm. high posteriorly, shining black in colour, the base bordered with a bright ring of yellow and a wider ring of velvety black. Thoracic feet and claspers of prolegs pale greenish.

One larva in this stage which moulted at 10 a. m. was green rather densely dotted with black. The dorsal vessel was almost obscure, but the subdorsal band was wide, even, and very distinct. The head was green washed with black. By noon, however, the specimen was blackish-brown.

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HYBRIDIZATION IN THE GENUS VIOLA.

By M. O. Malte and J. M. Macoun.

Certain sections of the genus *Viola*, as is well known, are characterized by that wonderful biological peculiarity, generally termed cleistogamy. The showy flowers of our spring violets generally live but a short time. Although being sexually perfect, i.e., having stamens and pistils normally developed, they generally wither down without producing any seed and the propagation of the individuals and the maintenance of the species are secured through the cleistogamous flowers. These generally appear comparatively late in the season and reach their fullest development after the showy spring flowers have disappeared. As a rule, the cleistogamous flowers are without petals or have them incompletely developed, for which reason they are often in descriptive botany, termed apetalous. The whole flower has the appearance of a half-grown bud arrested in its development. It is often inconspicuous to the eye because of its lack of attractive colours, or even wholly invisible to the casual observer because not rarely it reaches its full development hidden among the decomposed or half-decomposed remnants of plants which cover the ground, or it even flourishes beneath the surface of the soil.

These cleistogamous flowers, however, play the most important part in the life history of the individual as well as of the species. In spite of their seeming incompleteness, they produce, without being aided by outer agencies, all the seed needed for the maintenance of the species. Their pistils are automatically fertilized by the pollen shed from their stamens, the result being the production of an abundance of seed.

This mode of seed production, so different from the ordinary way, did not fail to attract the attention of botanists at least as far back as the 18th century. It was thought to be strange and inexplicable in times when sexuality in plants was still disputed and when the importance of sexual organs as foundations for a scientific plant system was first being discussed.

Linnaeus, in his *Species Plantarum*, described dozens of violets, giving their characters from the shape of the leaves and their general appearance. In only one case, however, did he mention the flower and fruit, and this was done solely because of the extraordinary biological feature encountered in a species which he called *V. mirabilis*. This species, which is found from Southern Sweden to the Alps of Switzerland, was described as follows:— "Viola caule triquetro, foliis reniformi cordatis, floribus caulinis apetalis." To this description was added especially: "Viola floribus radicalibus corollatis abortienatibus, caulinis apetalis seminiferis."[1] The mere description of this violet, which is now known as *V. mirabilis* L. indicates that Linnaeus considered it one of the wonders of the plant kingdom just because of its peculiar mode of fructification. Its showy spring flowers, proving themselves perfectly useless for the propagation of the species, contrasted singularly with the inconspicuous and seemingly imperfect flowers, which were developed later in the season from special shoots. But these inconspicuous flowers, although in their general aspect not betraying their importance, proved themselves capable of safeguarding the existence of the species. Small wonder that the name *V. mirabilis*—The Wonderful Violet—was given to this species.

In North America little attention seems to have been paid to the morphology and the biological and systematical importance of cleistogamy in violets by the early botanists. Its general occurrence in acaulescent violets, as far as the authors have been able to ascertain, was first accentuated by Dr. Edward L. Greene, whose observations dating from 1896, shed much greatly needed light on the morphology and biological relationships of North American violets. In the year 1896 Dr. Greene stated (according to extracts from *Cybele Columbiana* Vol. I, No. 1, 1914, p. 7) that "the very most common of our so called acaulescent violets, continued long after their short season of showy vernal flowering to put forth apetalous flowers from which are produced all or nearly all the seeds by which individuals are multiplied and the species perpetuated."

As the production of seed in the capsules of the apetalous flowers is the result of a process of self-fertilization and as furthermore the flowers in which this takes place, never open, it is evident that the seed developed in the cleistogamous flowers necessarily is perfectly pure, i.e., that it gives when sown a progeny of plants having the characters of the parent plants. In other words, through cleistogamy the pure lineage of the various species is infallibly upheld.

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[1] Linnaeus, Sp. Plant. 2, 936. 1753.

Although much more conspicuous and pretentious in aspect the ordinary showy petaliferous flowers of our violets are of far less importance for the propagation of the individuals than are the cleistogamous ones. This is evident from the fact that only in few cases do they produce any seed. Their life generally ends with the withering of their petals, shortly after which all traces of the whole flower are gone. In most cases, there is no postfloral maturing of capsules because the ovules are incapable of developing into germinable seeds. The reason for this sterility is simply that, as a rule, the petaliferous flowers are not fertilized. They lack the ability of self-fertilization and are consequently dependent for their fertilization on outer agencies. Furthermore, special arrangements and morphological peculiarities of the sexual organs, the nature of which need not be described in this connection, tend to make self-fertilization extremely difficult, if not wholly impossible.

Under these circumstances it is evident that when seed is found developed in the capsule of a petaliferous violet flower, it must be regarded as the result of a cross-fertilization between two flowers. These two flowers may belong to the same individual, to two different individuals of the same species or to two individuals of distinct species. To which one of these three possibilities the development of seed in the capsules of petaliferous flowers is to be attributed in individual cases can only be determined by a study of the progeny raised from this seed.

That the capsules of petaliferous flowers in most species of our violets frequently produce germinable seed, is beyond doubt. Actual observation supporting this statement are, however, rather scant. Brainerd[2] states that though the infertility of the petaliferous flowers has often been observed, he has "during the past season (1903) found these capsules to be usually fertile." In the vicinity of Ottawa the same observations have been made on *V. Macounii* Greene and the writers believe they could be easily made on practically all species of acaulescent violets were these more closely observed.

That fertilization of petaliferous flowers really often takes place, is demonstrated beyond a doubt, by the frequent occurrence of hybrids between different species of violets. As the formation of hybrids through cross-fertilization of the cleistogamous flowers is wholly out of the question the mere fact of their occurrence must necessarily prove that fertilization of and seed formation from petaliferous flowers often occur.

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[2] Rhodora, Vol. 6., p. 10.

In this paper the authors will endeavour to give a brief account of the general characteristics of violet hybrids and also a list of the hybrids recorded from the North American continent.

To the amateur botanist who has neither time nor inclination to study with earnest perseverance the multitude of violets occurring in our woods and meadows, the existence of intermediate forms between different species is at first apt to provoke confusion and discouragement. A closer study of those intermediate forms which at first may seem to blur the systematic boundaries between well defined extremes belonging evidently to different specific units will, however, instead of causing confusion, help most comprehensively to avoid it. In other words, the recognition of certain intermediate forms as casual hybrids will prove one of the most helpful means to the botanist endeavouring to arrive at a well founded understanding of the systematic value and relationship of our violets.

The hybrid nature of puzzling forms, apparently intermediate between two species, can be most easily determined.

The general appearance of hybrid plants, their vigorous vegetative development, their bright and abundant flowers and, generally speaking, their air of strength and splendour is often very characteristic. When odd plants displaying these marks are found in violet colonies composed of two or more species, they very often prove to be typical hybrids between well defined species.

The vegetative superiority of hybrids in plants is, however, a too well known feature to warrant a lengthy discussion. It is sufficient to say for the sake of illustration, that for instance hybrids in the genus Epilobium and in grasses are always characterized by their conspicuously vigorous vegetative organs. Not only do they display a most luxuriant growth as far as foliage and profusion of shoots are concerned, but their ability to survive and hold the ground is far more pronounced than that of any of their parents. Several observations have thus been recorded to the effect, that hybrids between species of Epilobium, originating in a ditch or any other area of limited extension, are able on account of the superior strength of their vegetative organs, after a few years, to take possession of every inch of the ground, killing every plant of the species from which they originated. Similar observations have been made on violet hybrids. In botanic gardens, where several species of violets are grown in close proximity, it has been recorded that species, after a few years, often have been killed and replaced by more vigorous hybrid plants.

The conspicuous vegetative development of certain wild violet forms, the systematic value of which may at first seem difficult to understand, may therefore often indicate, to the student of violets, their hybrid value. It must be understood, though, that however helpful be the general characteristics briefly hinted at above for the recognition of hybrids, the decision as to whether a suspected form be really a hybrid or not can be satisfactorily reached only through a minute study of its morphological and sexual characteristics. This means not only that a violet in order to be classified as a hybrid, should be intermediate between supposed species as far as vegetative characters are concerned, but also, and particularly, that the morphological and cytological development of its sexual organs should most strongly support its supposed hybrid nature. In doubtful cases, the functional capacity of the pollen and the ovula must really furnish the final decision on the question whether a certain individual should be regarded as a hybrid or not. Space will not permit that in this article European literature bearing upon the subject of hybridization as influencing the development of sexual organs in violets be quoted. This is also, in fact, unnecessary as numerous observations relating to the subject have been recorded in North America. This is especially true as far as the development of seeds in hybrid violets are concerned, in other words, as far as the development of, or rather the failure of development of the female organs is concerned.

Strangely, but as a matter of fact most naturally, contrasting with the luxuriant growth of the vegetative organs of a violet hybrid stands its more or less marked sexual impotence, i.e., its incapability, to a greater or less degree, of reproducing itself sexually. Generally a violet hybrid is markedly barren and although developing numerous capsules and ovules fails to produce an adequate number of germinable seeds.

A few quotations from one of the excellent papers of Dr. E. Brainerd[3] on the subject will suffice. Thus, describing the hybrid plants between *V. septentrionalis* and *V. fimbriatula* Dr. Brainerd says that "in the late summer they produce numerous cleistogamous flowers and fruit, but nine-tenths of the ovules remain unfertilized."[4] Observations on hybrid plants of the combination *V. cucullata* x *fimbriatula* also reveal the fact that specimens of the same in their cleistogamous flowers, develop capsules which either contain only a few ripened seeds or even become "brown and withered as though entirely unfertilized."[5] The hybrid *V. fimbriatula* x *sororia*, according to Dr. Brainerd, is less sterile than most hybrids, but never was a capsule found that contained more than half the normal number of seeds.[6] Also in other hybrids, the characteristic sterility of the capsules is most typical. Thus, *V. cucullata* x *septentrionalis* was found to bear only from one to six seeds[7] and, in the hybrid *V. septentrionalis* x *sororia*, "the uniformly stunted and often distorted capsules containing mostly aborted ovules"[8] clearly betrayed its mongrel origin. In *V. affinis* x *sororia* the capsules of the cleistogamous flowers were found to be small and often one-sided and relatively infertile[9] and in *V. cucullata* x *sororia* although numerous, proved to be all small, imperfect and few seeded."[10]

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[3] Rhodora, Vol. 6. pp. 213–223.

[4] l.c. 216.

The above quotation will suffice to substantiate what was stated without confirming evidence on a previous page, namely, that in a hybrid between two violet species, the faculty of producing the normal amount of germinable seed is most conspicuously reduced. To avoid misconception, it may be pointed out, especially, that the degeneration of the sexual organs mentioned above refers to the cleistogamous flowers, that is to say the flowers, which in specimens belonging to a "good" species normally produce an abundance of well developed seed. As the cleistogamous flowers are always self-fertilized this failure, in hybrid plants, to bear seed of normal reproductive vigour, cannot be explained by assuming that the pollen necessary for the fertilization of the ovules has not been available. It can be explained only by recognizing the fact that the mixing of and unnatural union of sexual units, belonging to distinct species, in the reproductive organs of the hybrids, is causing a disturbance of the functions of the sexual cells which manifests itself in partial or total sterility.

The inability of the cleistogamous flowers of hybrid plants to produce seed of normal vitality is thus very pronounced. This being the case, it is evident that when violet plants are found having sterile cleistogamous flowers they may be looked upon as possible hybrids. In fact, such plants in most cases are really hybrids. The sterility of the capsules of the cleistogamous flowers in violets is therefore a character which will prove most helpful for the identification of critical forms as hybrids.

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[5] l.c. 217

[6] l.c. 218

[7] l.c. 220

[8] l.c. 221

[9] l.c. 222

[10] l.c. 222

(To be continued)

FAUNA OTTAWAENSIS.*

ORDER LEPIDOPTERA: FAMILY NOCTUIDÆ; SUBFAMILY PHYTOMETRINÆ.

BY ARTHUR GIBSON.

In a study of the species of moths of this subfamily occurring in Eastern Canada as classified by Hampson in Vol. XIII of the Catalogue of the Lepidoptera Phalaenæ in the British Museum (1914), I have been interested in listing the species which have been found in the Ottawa district. This list is presented herewith, together with some larval notes on certain species. These latter add to our knowledge of the early stages of these insects. Many of the moths in this subfamily were formerly classified under the generic name *Plusia* and more recently under the genus *Autographa*. The former generic name, however, has now gone into the synonomy, while only one species of the latter genus occurs in Canada, namely, *Autographa parilis*, which has been collected in British Columbia.

The letter "G" following the records indicates that the specimens were collected by me, the letter "F" by the late Dr. James Fletcher, and the letter "Y" by Mr. C. H. Young.

Syngrapha falcifera Kirby. 18, 30, 31 May, 1899; 1 June, 1900; 6 June, 1901; 7 June, 1899; 10 June, 1902; 12 June, 1901; 15 June, 1904; 16 Aug., 1900; 11 Sept., 1902; 25 Sept., 1899; 26 Sept., 1903; 1 October, 1900, (G).

In 1901, I secured eggs of this species from a living female and the larvæ were reared on common plantain. Some were mature and spun cocoons on June 27, and moths emerged on July 8, 10 and 12. During the same year I received a larva from Toronto which was found feeding on wild lupine, *Lupinus perennis* L. This specimen pupated on July 1, the moth emerging on the 18th idem.

Syngrapha epigaea Grt. 6 Aug., 1901, (Y); 22 Aug., 1904, (F); 27 Aug., 1902; 30 Aug., 1899, (G).

Snygrapha selecta Walk. 18, 22 Aug., 1900, (Y); 27, 28 Aug., 1902, (G).

Syngrapha rectangula Kirby. 30 July, 1902, (Y); 11 Aug. 1902, (G); 18 Aug., 1900, (G); 19 Aug., 1900, (Y).

Syngrapha octoscripta Grt. 26, 29 June, 1903, (Y); July, 1886, (F); 21 Aug., 1902, (G); 21 Aug., 1900, (Y); 23 Aug., 1902, (Y); 30 Aug., 1899, (G).

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*Contribution from the Entomological Branch, Department of Agriculture, Ottawa.

Eosphoropteryx thyatyroides Gn. 2, 6, 19 Aug., 1905, (Y).

Pseudeva purpurigera Walk. 12, 19 July, 1902, (Y); 20 July, 1905, (G); 21 July, 1903, (Y); 28 July, 1904, (Y); 29 July, 1906, (Y).

Phytometra brassicæ Riley. 10 Aug., 1911, (G); 16 Aug., 1900, (G); 31 Aug., 1900, (Y); 3 Sept., 1900, (G); larva on cabbage 5 Sept., pupated 13 Sept., moth emerged in cellar 26 Sept., 1908, (F).

This is a common economic pest of cabbages in the United States, but fortunately it has not as yet appeared as a very destructive species in Canada. In 1907, the larvæ were found rather commonly in a large greenhouse in Toronto where lettuce was being grown. Specimens forwarded to me changed to pupæ on Jan. 27, the moths emerging at Ottawa on Feby. 23. In the Ottawa district I have occasionally found the larvæ on cabbage.

Phytometra rubida Ottol. 5 June, 1905; 13 June, 1906; 17 June, 1904, (Y).

Phytometra putnami Grt. 6, 12, 15 June, 1901, (G); 14, 21 June, 1899, (Y); 23 June, 1908, (G); 26 June, 1905, (F); 28 June, 1899, (G); 14 July, 1899, (G).

Phytometra contexta Grt. 1, 2, 5, 12 June, 1899, (G); 7, 12, 13 June, 1901, (G); 18 June, 1904, (G); 8 July, 1905, (F); 11 Aug., 1903, (Y); 12, 29 Aug., 1902, (G); 13 Aug., 1904, (G); 21 Aug., 1904, (Y); 25 Aug., 1899, (G); 23 Sept., 1911, (Beaulne).

In 1901 eggs were secured from a captive female. Oviposition took place June 14, and the larvæ hatched June 19, the egg stage being thus five days. The larvæ fed readily on Kentucky Blue Grass.

Phytometra biloba Steph. 29, 30 June, 1903, (Y); 2, 3 July, 1903, (G); 2 July, 31 Aug., (Y); 3 Sept., (G); 24 Sept., 1900, (F); 22 Oct., 1903, (G).

Mr. Young has found the larvæ at Ottawa on clover.

Phytometra oo Cram. 25 May, 1903, (G).

This specimen was named *rogationis* by Ottolengui. This however, is placed, by Hampson, as a synonym of *oo*.

Phytometra precationis Gn. 25, 30, 31 May, 1899, (G); 2, 7 June, 1899, (G); 5 June, 1894, (F); 10 June, 1902, (G); 18 June, 1904, (G); 25 July, 1900, (Y); 12 Aug., 1904, (G); 24, 26 Aug., 1899, (G); 30 Aug., 1900, (G); 10 Sept., 1908, (G); 15 Sept., 1899, (G); 24 Sept., 1900, (G).

Common around flowers in late May and June. Many specimens have been seen frequenting the flowers of *Cara-*

gana and other shrubs in the arboretum, Central Experimental Farm. In 1905, eggs were secured from a captured female. They were laid on July 1st and hatched on July 7th. The larvæ in Stage I were pale greenish, skin smooth and shiny, the segments rather deeply divided. Tubercles small, black, each bearing a blackish bristle. Head semi-translucent with a brownish tinge; mouth parts yellowish-brown; ocelli black. Thoracic feet concolorous with head; prolegs concolorous with body. Moulted 14 July. My note on Stage II reads: Length 6.5 mm., pale greenish cylindrical larvæ, with black tubercles, each with a rather long stiff black bristle—much the same as Stage I. Head paler than body. No further notes were taken owing to pressure of other work. The mature larva has been described fully by Chittenden.*

On July 8, 1901, specimens of the larvæ of this species were found at Ottawa feeding on common plantain, *Plantago major*. Pupation took place on July 12, and the moths appeared about a fortnight later. In 1912, I found a larva on cabbage, which changed to pupa on July 30, the moth emerging on Aug. 19. Mr. C. H. Young has found the larvæ feeding on grass and clover.

Phytometra bimaculata Steph. 30 July, 1906, (G); 23 July, 1904, (Y); 6 Aug., 1902, (Y); 11 Aug., 1901, (G).

Phytometra mappa G. & R. 26 June, 1904, (Y).

In addition to this specimen Mr. Young collected a female moth from which he secured eggs. The young larvæ were fed on dandelion and by autumn had grown to rather more than half an inch in length. They stopped feeding and acted as if they wanted to hibernate. They died, however, before winter.

Phytometra ampla Walk. 13 June 1899, (G); 19 June, 1901, (Y); 20, 29 June, 1903, (Y); 23 to 28 June, 1903, (Y); 23 June, 1908, (G); 7 July, 1903, (Y); 6, 9 Aug., 1901, (Y).

Phytometra æreoides Grt. 24, 30 June, 1904, (Y); 7 July, 1899, (G); 7 July, 1899, (Y); 7 July, 1902, (Y); 8 July, 1905, (F); 24 Aug., 1904, (Y).

On May 28, 1901, I found the larvæ fairly aeundant, on a hillside near the Rideau Canal, feeding on *Solidago canadensis*. The larvæ were nearly full grown and it was extremely difficult to see them on the food plant. They were nearly all collected by "beating." The following descrip-

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*Bull. 33, U.S. Div. Ent., p. 71.

tion was taken: Length when mature 34 mm., cylindrical in shape, tapering towards the head, which is slightly smaller than segment 2. The whole of the body is pale green, the dorsal vessel a darker green. The dorsum is covered with short, whitish, crooked lines, which slope from about 1 mm. above the stigmatal band to a faint, whitish crooked line which borders the thin median skin through which the dorsal vessel is seen. Stigmatal band yellowish-white; spiracles whitish, ringed with black. All the feet concolorous with body. Head slightly paler than body, no markings; ocelli black; tips of mandibles blackened. The larvæ spun cocoons and pupated soon after collection, and the moths emerged on June 9 and 10.

A very brief description of this larva was published by Thaxter in 1876.*

Phytometra ærea Hbn. 18 July, 1899, (G); 18 July, 1899, (Y); 12, 19, 22 Aug., 1900, (Y); 16, 24, 30 Aug., 1900, (G); 15 Sept., 1899, (G); 1 Oct., 1902, (G).

A single larva of this species was found on mint at the Central Experimental Farm, on May 9, 1901, from which the following description was drawn: Length 31 mm. Head 2 mm. wide, rounded, slightly indented at vertex, lobes full; concolorous with body excepting antennæ, which are paler and slightly brownish at tips; mouth parts also slightly brownish; ocelli black; hairs on face slender. Body cylindrical, plump, tapering towards extremities, light green on dorsum, dark green on sides and venter, the whole body spotted with white dots. From centre of dorsum to spiracles are five stripes, all white with exception of spiracular stripe, which is yellow. Spiracles faintly orange, ringed with black. Tubercles normal, white, setae dark, tubercle IV in a line posterior to lower end of spiracle. Thoracic feet and prolegs concolorous with venter. On May 13 the larva began to spin its cocoon, and by the 16th had changed to pupa. The moth emerged on June 4. In 1899 a cocoon was found on a celery leaf, the moth emerging on Aug. 10.

Phytometra balluca Geyer. 7 July, 1899, (G); 7 July, 1903, (Y); 9, 14 July, 1900, (Y); 20 July, 1904, (G); 9 Aug., 1900, (G).

Mr. Young has found the larva on cabbage, from which he reared the moth on 13 Sept., 1906. Fletcher, in 1878, found the larva at Billings' Bridge feeding on Red

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*Psyche, vol. 1, p. 188.

Raspberry, and in 1880 on mint. The pupa is a striking object, being of a cream colour beautifully marked with a wide, irregular, broken, black band on dorsum and a row of lateral black spots. In length it is about 20 mm.

Palæoplusia venusta Walk. 2 July, 1899, (Y); 24 Aug., 1900, (Y); 27 Aug., 1902, (G); 30 Aug., 1899, (G).

Abrostola urentis Gr. 19 Aug., 1900, (Y).

The moths have also been reared by Mr. Young from mature larvæ collected on 15 Aug., 1898, 15 Sept., 1899, and 8 June, 1905. The larvæ were found on nettle. I have recently had an opportunity of examining two inflated specimens. The caterpillar is a rather handsome one, being pale green in colour or pale brownish, with whitish V-shaped marks on dorsum, one on each abdominal segment, the sides of which inwardly are bordered with pale brown in the green specimens and darker brown in the pale brownish variety. On segments 5, 6 and 12, the lower portion of the V-shaped mark is filled with brown, an indistinct whitish dorsal stripe is present, and a wide white stigmatal band bordered above with brown. On either side of each abdominal segment is a wide oblique dark dash. Head pale green, reticulated with brown. Down the centre of each cheek is a darker band of brown and on either side a wide margin of the same colour. In the brownish larvæ the head is of a much darker brown, the reticulations being very distinct. The thoracic feet are pale brown, the prolegs being concolorous with the body. The posterior half of the anal feet are brown.

RANDOM BOTANICAL NOTES FROM PORTNEUF COUNTY, QUE.

BY BRO. M. VICTORIN, of the Christian Schools, Longueuil College, Que.

Botanically speaking, the Laurentian area of Quebec is very nearly untrodden ground. It has been the good fortune of the writer to spend a full week on the upper part of the River Ste. Anne, Portneuf Co., towards St. Raymond and the vicinity, and to observe some of its prominent floristic features.

As could be expected we find that the flora of the district, though not differing essentially from that of the Laurentian zone north of Montreal, exhibits, nevertheless, a somewhat more pronounced boreal aspect.

The whole valley is densely drifted with heavy sand and clay deposits, obliterating the underlying crystalline rocks.

Getting in the field at the end of July, we are at first impressed by the local abundance of *Habenaria clavellata* (Michx.) Spreng., an orchid very little known in this province. Evidently it is the leading *Habenaria*, thriving in every mossy corner. On the scanty sandy covering of the rocky slopes, it is interesting to note a peculiar grass, *Danthonia compressa* Aust., the range of which as given in Gray's Manual, "Maine to New York and southward" should be thus considerably extended.

Kneeling to drink from a drying spring we come by a tiny *Sparganium* which turns out to be *Sparganium acaule* (Beeby) Rydb., a critical species we will meet under various puzzling forms later in the season, in the Temiscouata region. The ponds swarm with *Sagittaria latifolia* Willd., and *Calla palustris* L., while *Carex trisperma* Dewey is a common sedge in sphagnum swamps. Characteristic enough of the open-ground flora are *Galium asprellum* Michx., *Comandra livida* Richards, *Veronica officinalis* L., and *Hieracium scabrum* Michx.

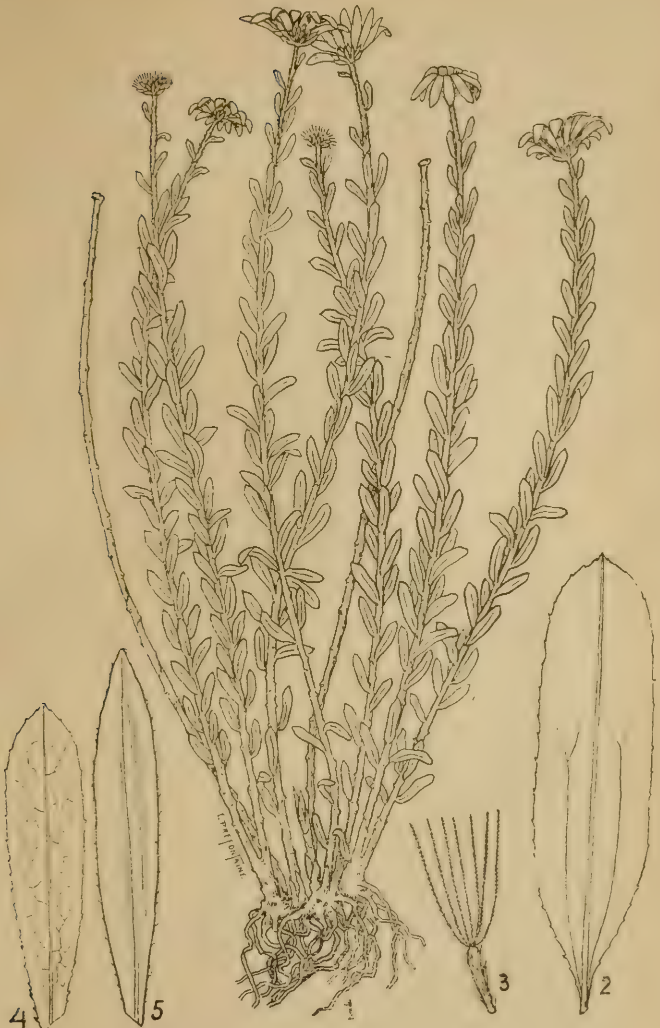
We notice with considerable displeasure very extensive patches, where the hirsute rosettes of *Hieracium Pilosella* L., check all other vegetation. We have elsewhere (¹) drawn attention to this dangerous invader from the Maritime Provinces which spreads with alarming rapidity.

Going down the river to "Chute à Panet," where an important pulpmill dams the waters, we make a find of more than ordinary interest. *Aster linariifolius* L. was of doubtful record in Quebec, its supposed northern limit being latitude 45 degrees. It was therefore a surprise to see that beautiful blue-rayed Aster covering the exposed gneissic rocks in the river, just below the dam. But the plant, though belonging undoubtedly to *A. linariifolius* L., differed from the typical form in its less rigid leaves and shorter oblong-linear, mostly round-tipped, ascending leaves, and in having the oblong-linear obtuse bracts of the involucre more hebaceous. It then proves to be a well-pronounced geographic variety, which through the courtesy of Professor M. L. Fernald, of the Gray Herbarium, now stands thus: (²).

Aster linariifolius L., var. *Victorinii* Fernald (nov. var.) Humilis 1-1.6 dm. altus; foliis adscentidibus vel patentibus confertis viridibus oblongo-linearibus, longioribus 1.3-1.8 cm. longis 2-4 m.m. latis, apice rotundatis vel obtusis, Quebec:

(¹) Naturaliste Canadien, XL : 86

(²) Rhodora, XVI : 192



Aster linariifolius L., var. Victorinii Fernald.

1. The plant—natural size
2. A leaf—x 4
3. Akene with pappus—x 4
4. Outer bract of the involucre—x 8
5. Inner bract of the involucre—x 8

On rocky banks of River Ste. Anne, St. Raymond, Portneuf Co., August, 1914, Bro. M. Victorin, No. 618. (Type in Gray Herbarium).

While travelling on the Canadian Pacific Railway between Montreal and Quebec, we noticed that a small blue-rayed Aster occupied an extensive tract of sandy ground between Trois-Rivières and Champlain. We are quite convinced it is *A. linariifolius* L., but whether it is the typical form or the variety *Victorinii*, or an intermediate between them, is yet to be determined.

Before leaving "Chute à Panet," *Gentiana linearis* Froel., a lover of the near-by moist thickets must be mentioned.

Some ten miles north of St. Raymond the country becomes thoroughly wild, and partly cultivated land gives way to fish and game territories, dotted with innumerable lakes.

If we go up the so-called main branch of the River Ste. Anne, we enter a most picturesque region, well-known to sportsmen under the self-explanatory name of *Pique-Mouche*. There begins the famous Tourili Club Territory. From the Club-House, a *Chemin de Portage* takes us to 1000 feet over a hill before we tramp to the grassy shores of the first of a magnificent series of lakes, Lake Ouastaouan. This small lake looks much as if artificially induced by the industry of beavers. It is quickly disappearing owing to the deposition of mud, and a vigorous growth of carices and water-lilies.

We were pleased to record here the presence of a much critical plant whose distribution is little known with us: *Nymphaea rubrodisca* (Morong) Greene, a probable hybrid between *N. Americana* (Prov.) Miller & Standley, and *N. microphylla* Pers. The numerous uprooted rhizomes indicate that the beavers of the Ouastaouan rely on this plant for food.

The shallow ends of the lake maintain a hydrophytic association of some interest: *Myriophyllum Farwellii* Morong, *Myriophyllum verticillatum* L., var. *pectinatum* Wallr., the loose submerged form of *Hippuris vulgaris* L., and *Utricularia macrorhiza* Le Conte.

Though very little attention was devoted to cryptogams, we noticed *Icmadophila ericetorum* (L.) Azahlbr., a crustose lichen expanding its thallus horizontally on tight dying sphagnum hummocks; *Dicranum longifolium* Ehrh., a frequent moss in the Laurentides grows in high situations.

Perhaps the most pleasant outing a nature lover can make in this part of the country is to take the "Little Saguenay" trip. You go up the Bras du Nord to a distance of about fifteen miles, entering gradually into a canyon well deserving the name it bears: "Little Saguenay." The scope of these notes does not permit us to dwell on the most interesting remains of the glacial period to be observed there. Let it be sufficient to say that the glacier has passed through that narrow valley, has notched some of the peaks in odd fashion, and left numerous kames and moraines.

A relatively good *Chemin de Portage* begins on the right bank of the river, and ascends very quickly to a height of 1100 feet where Lake Hauteur sleeps on the edge of the cliff with a bald, notched and grim looking gneissic peak, sitting on its silent shores. A little vigorous paddling brings us to the opposite shore, where another *Chemin de Portage* starts. This, roughly laid on the rich humus carved by the royal hoof of the moose, winds for miles through the magnificient northern forest, until we reach another small sheet of water, Lake Epinette. Our aneroid now shows 1300 feet above the level of the river, and the herbaceous vegetation becomes more typically boreal, as it appears by the growth of *Luzula parviflora* (Ehrh.) Desv., nodding its dishevelled heads over cold springs, and especially *Galium Kantschaticum* Steller, an arctic-alpine species hitherto unknown from the Laurentian district. Very common is *Epipactis tessellata* (Lodd) A. A. Eaton, all along the *Chemin de Portage.*

Numerous mosses, lichens and hepatics thrive in these essentially mesophytic conditions. Sloping down damp rocks are thick cushions of *Sphagnum Girgensöhnii* Russ., and *Sphagnum quinquefarium* (Lindb.) Warnst., with stiffer groups of *Polytrichum Ohioense* R. &. C. framing the reddish masses of *Scapania nemorosa* (L.) Dum., while the pallid *Trichocolea tomentella* (Ehrh.) Dum., creeps in magnificent attire.

In every fresh spot, *Mnium affine* Bland., *Plagiothecium Ruthei* Limpr., *Brachythecium rivulare* B. & S., *Drepanocladus uncinatus* (Hedw.) Warnst., are to be found.

The shallow margin of Lake Epinette is strewn with the black alga-like masses of the hydrophytic *Fontinalis Novae-Angliae* Sulliv. But much more interesting is the fact that the line brings from a bottom of fifteen feet a compound of *Drepanocladus capillifolius* Warnst., and a submerged form of *Sphagnum subsecundum* Nees., which, according to Dr. A. Leroy Andrews, has been made a Warnstorfian species, namely *Sphagnum obesum* Wils.

To close these notes we will only mention a visit to Lake Sept-Iles, which gave us *Glyceria Torreyana* (Spreng.) Hitch., with the usual *Eriocaulon septangulare* With., and *Lobelia Dort-*

mamma L. Moreover in a corner of that lake which has developed into a peculiar type of peat bog, and has received the name of "Lac des Bouleaux," we find, extremely abundant, *Nymphaea rubrodisca* (Morong) Greene, already mentioned from Lake Ouastaouan. We are, therefore, led to the conclusion that this hybrid water-lilly is very common with us, and generally overlooked. We are satisfied also that, fragmentary as they are, these observations lead to extend considerably northward the range of such interesting species as *Aster linariifolius* L., *Galium Kamtschaticum* Steller, *Danthonia compressa* Aust., etc.

BIRD NOTE.

The present winter, thus far, has been a comparatively mild and open one, the recent thaw having laid bare the hillsides and reduced the lower levels to small ponds. I covered eight miles to-day cross-country on Isle Jesus without the use of snowshoes.

In a farming district, where decayed vegetation and other refuse was lying about, I observed a flock of 25 crows, the birds passing and chasing one another as they moved in a southerly direction. The familiar caws reminded one of days in March when migration is at its highest. Crows seldom remain with us during the winter and whether their presence now indicates a continuance of mild weather and an early spring, remains to be seen.

WESTMOUNT, QUE.
January 17th, 1915. W. J. BROWN.

ERRATA.

In the account of the meeting of the Botanical Branch, held on Nov. 14, 1914, published in the December issue of this volume two slight errors occurred which should be corrected.

On page 118, it is stated that "Dr. Malte dealt more particularly with forage roots such as mangels, turnips and sugar beets. He pointed out that the original wild form of such root crops consisted of a creeping form found on the sand of the coatal regions of Europe." The wild plant referred to, is *Beta maritima*, from which our cultivated mangels and sugar beets have been developed. This plant has, of course, nothing whatever to do with the turnip varieties which have been developed from species of *Brassica*.

On page 119, it is further stated that, in the district of Yarmouth, N.S., "eleven hundred pounds of seed per acre is about the average for mangels." This statement should not refer to mangels, but to turnips.

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HYBRIDIZATION IN THE GENUS VIOLA.

By M. O. Malte and J. M. Macoun.

(Continued from page 150).

As, however, the cleistogamous flowers are developed comparatively late in the season, their failure to produce normal seed can be utilized as a means of determining the hybrid nature of critical forms only by those students who have the opportunity of studying the violets after the showy petaliferous flowers have wholly or mostly disappeared, i.e., at a time when the amateur botanist generally considers the violet season a matter of the past.

Early in the season, before the capsules of the cleistogamous flowers are beginning to ripen, the hybrid nature of suspected plants can be most satisfactorily ascertained through an examination of the pollen of their showy, petaliferous flowers, as it is not only the sexual cells of the cleistogamous flowers which are affected by hybridization, but also those of the petaliferous ones. In other words, the whole sexual apparatus of a hybrid plant, including both male and female organs, is conspicuously deteriorated and incapable of normal functions.

The stamens of a violet flower have, as is well known, very short filaments, sometimes hardly visible to the naked eye. Their anthers, on the other hand, are broad and composed of two cells, separated by a rather conspicuous connective. The latter carries on its top a peculiar appendage which is generally brown or reddish brown. The anthers proper, that is to say, the portion of the stamens below the appendages, are placed close together and have the appearance of a cupola, from the centre of which emerges the pistil. In their cells they carry numerous pollen grains which, when normally developed, appear more or less triangular, quadrangular, or elliptic, depending upon the species and also on from which side they are viewed.

The pollen grains of a stamen taken from a plant belonging to a good species, are all uniform as to size and general appearance. When examined in a drop of water under a microscope magnifying 200 to 500 times they appear opaque and of a dull grayish colour, owing to the fact that they are filled with a rich and slightly granulated protoplasma.

The opaque appearance of the pollen grains and also their uniformity are characters which can be observed not only on living plants but also on pressed material which has been kept dry for many years.

The appearance of the pollen, developed by a hybrid plant, is quite different. In the first place, the pollen grains are far from uniform in size and shape. Only a few reach the size of those of a good species, the majority being much smaller. They appear irregular in outline, are often shrunken and always of a bright colour. Examined under a microscope with a low magnification, say 100 times, the pollen from a hybrid violet gives an impression of emptiness and sexual incapacity. Examined under higher magnification, most of the pollen grains prove really, to be empty or filled with a watery content. Even those grains which, under lower magnification, appear to be fairly normal, prove to be filled with a very poor and watery protoplasma, and are therefore almost transparent.

The percentage of good sized grains in pollen of violet hybrids varies with the combination of the hybrid. The closer the species from which a hybrid has been formed are related to each other, the less degenerated becomes the pollen of the hybrid. Those hybrids, however, which are formed from systematically widely separated species, have an extremely poor pollen, the percentage of evidently wholly useless pollen grains often running as high as 95 per cent or more.

The sterility of the pollen in the petaliferous flowers of hybrid violets is, briefly, just as marked as the sterility of the capsules of the cleistogamous ones and consequently furnishes an equally excellent means whereby, in doubtful cases, the hybrid nature of violet plants can be ascertained.

The fact that hybrids between distinct species of violets show reduced sexual capability, should evidently be of great assistance to students endeavouring to reach a clear understanding of the systematic relationships of closely allied forms, inasmuch as the sterility or fertility of intermediates between such forms may decide whether the forms in question represent distinct specific units or merely are varieties of one species.

This question will, however, not be further discussed in the present paper.

The following is a list of violet hybrids which so far have been recorded in North America.

V. affinis x *Brittoniana* Dowell, Bull. Torr. Bot. Club. 37, 169.
“ x *cucullata* Brainerd, Rhodora 8, 49.
“ x *fimbriatula* Dowell, Bull. Torr. Club. 37, 170.
“ x *hirsutula* Dowell, Bull. Torr. Bot. Club. 37 171.
(= *V. affinis* x *villosa* Brainerd, Rhodora 8, 56.)
“ x *nephrophylla* Brainerd, Rhodora 8, 50.
“ x *palmata* Dowell, Bull. Torr. Bot. Club. 37, 171.
“ x *papilionacea* House, Rhodora 8, 119.
“ x *sagittata* Brainerd, Rhodora 8, 55.
“ x *septentrionalis* Brainerd, Rhodora 6, 219.
“ x *sororia* Brainerd, Rhodora 6, 221.
V. Brittoniana x *cucullata* House, Bull. Torr. Bot. Club. 32, 255.
(= *V. notabilis* Bickn. Torreya 4, 131).
“ V. *cucullata* x *septemloba* Brainerd, Rhodora 8, 52.)
“ x *emarginata* House, Rhodora 8, 120.
(= V. *emarginata* x *septemloba* Brainerd, Rhodora 8, 53.)
“ x *fimbriatula* Dowell, Bull. Torr. Bot. Club. 37, 172.
(= *V. Mulfordæ* Poll. Proc. Soc. Biol. Wash. 15, 203).
“ *V. fimbriatula* x *septemloba* Brainerd, Rhodora 8, 51.)
“ x *lanceolata* Forbes, Rhodora 11, 15.
“ x *palmata* nom. nov.
(= *V. palmata* x *septemloba* Brainerd, Rhodora 8, 55).
“ x *papilionacea* Dowell, Bull, Torr. Bot. Club. 37, 173.
“ x *sagittata* House, Rhodora 8, 120.
(= V. *sagittata* x *septemloba* Brainerd, Rhodora 8, 51.)
“ x *sororia* Dowell, Proc. Staten Isl. Ass. 3, 162.
V. cucullata x *fimbriatula* Brainerd, Rhodora 6, 217.
(= *V. Porteriana* Poll., Bull. Torr. Bot. Club. 24, 404).
“ x *nephrophylla* Brainerd, Rhodora 8, 50.
“ x *palmata* Brainerd, Rhodora 15, 115.
(Not *V. cucullata* x *palmata* Brainerd, Rhodora 8, 56. which is *V. cucullata* x *triloba* Brainerd, Rhodora 15, 115.)
“ x *papilionacea* Brainerd, Rhodora 8 ,56.

V. cucullata x *primulifolia* Brainerd, Rhodora 11, 115.
(= *V. lavandulacea* Bickn. Torreya 4, 130, *V. cucullata* x (?) *emarginata* Brainerd, Rhodora 8, 52.)
" x *sagittata* Brainerd, Rhodora 8, 52.
" x *septentrionalis* Brainerd, Rhodora 6, 220.
(*V. melissaefolia* Greene, Pitt. 5, 103.)
" x *sororia* Brainerd, Rhodora 6, 222.
" x *triloba* Brainerd, Rhodora 15, 115.
(= *V. cucullata* x *palmata* Brainerd, Rhodora 8, 56.)

V. emarginata x *hirsutula* nom. nov.
(= *V. emarginata* x *villosa* House, Rhodora 8, 120.)
" x *papilionacea* House, Rhodora 8, 120.
" x *sororia* Dowell, Proc. Staten Isl. Ass. 3, 162.

V. fimbriatula x *hirsutula* Dowell, Bull. Torr. Bot. Club. 37, 175.
(= V. *fimbriatula* x *villosa* House, Rhodora 8, 121.)
" x *palmata* Brainerd, Rhodora 15, 114.
(Not *V. fimbriatula* x *palmata* Brainerd, Rhodora 8, 51, which is *V. fimbriatula* x *triloba*, Brainerd, Rhodora 15, 114).
" x *papilionacea* Brainerd, Rhodora 8, 54.
(= V. *papilionacea* var. *aberrans* Stone.)
" x *septentrionalis* Brainerd, Rhodora 6, 215.
" x *sororia* Brainerd, Rhodora 6, 218.
" x *triloba* Brainerd, Rhodora 15, 114.
(= *V. fimbriatula* x *palmata* Brainerd, Rhodora 8, 53.)

V. hirsutula x *palmata* Brainerd, Bull. Torr. Bot. Club. 39, 96.
(Not= *V. palmata* x *villosa* Brainerd, Rhodora 8, 56, which is *V. hirsutula* x *triloba* Brainerd, Bull. Torr. Bot. Club. 39, 95.)
" x *papilionacea* Brainerd, Rhodora 9, 98. (= *V. villosa* var. *cordifolia* Nutt., *V. papilionacea* x *villosa* House, Rhodora 8, 121.)

V. hirsutula x *sororia* Dowell, Bull. Torr. Bot. Club. 37, 176.
" x *Stoneana* Brainerd, Bull. Torr. Bot. Club. 39, 96.
(= *V. Stoneana* x *villosa* House, Rhodora 8, 121.)
" x *tribola* Brainerd, Bull. Torr. Bot. Club. 39, 95.
(*V. palmata* x *villosa* Brainerd, Rhodora 8, 56.)

V. lanceolata x *primulifolia* Dowell, Bull. Torr. Bot. Club. 37, 176.
V. latiuscula x *triloba* Brainerd, Bull. Torr. Bot. Club. 39, 94.
V. nephrophylla x *pedatifida* Brainerd, Bull. Torr. Bot. Club. 39, 94. (= *V. Wilmattæ* Poll. and Cockerell, Proc. Biol. Soc. Wash. 15, 178.)
V. oconensis x *sagittata* House, Torreya 7, 136.
V. pallens x *primulifolia* Dowell, Bull. Torr. Bot. Club. 37, 177.
V. palmata x *papilionacea* Dowell, Bull. Torr. Bot. Club. 37, 177,
" x *sagittata* Brainerd, Rhodora 15, 115. (Not *V. palmata* x *sagittata* Brainerd, Rhodora, 8, 54, which is *V. sagittata* x *triloba* Brainerd, Rhodora 15, 115.)
" x *triloba* Brainerd, Bull. Torr. Bot. Club. 39, 88. (= *V. Angellae* Poll., Torreya 2, 24, *V. palmata* var. *Angellae* (Poll.) Stone, Proc. Acad. Phila. 1903, 678.)
V. papilionacea x *pedatifida* Brainerd, Bull. Torr. Bot. Club. 40, 249.
" x *sagittata* Brainerd, Rhodora 8, 54.
" x *sororia* Dowell, Bull. Torr. Bot. Club. 37,178.
" x *Stoneana*, Brainerd, Bull. Torr. Bot. Club. 39, 93.
" x *triloba* Brainerd, Bull. Torr. Bot. Club. 39, 90.
V. pedatifida x *sagittata* Brainerd, Bull. Torr. Bot. Club. 40, 252.
" x *sororia* Brainerd, Bull. Torr. Bot. Club. 40, 253.
V. sagittata x *triloba* Brainerd, Rhodora 15, 115. (= *V. palmata* x *sagittata* Brainerd, Rhodora 8, 54.
V. septentrionalis x *sororia* Brainerd, Rhodora 6, 221.
V. sororia x *triloba* Brainerd, Bull. Torr. Bot. Club. 39, 92. (= (?) *V. populifolia* Greene Pitt. 3, 337.)
V. Stoneana x *triloba* Brainerd, Bull. Torr. Bot. Club. 39, 93.

Of the above hybrids, totalling not less than sixty, only two have been recorded from Canada.

These are *V. cucullata* x *septentrionalis* and *V. fimbriatula* x *septentrionalis*.

V. CUCULLATA X SEPTENTRIONALIS.

This hybrid was first described by Dr. Greene[11] as *V. melissaefolia* from specimens collected in 1902 by Mr. L. W. Watson on Prince Edward Island. Its hybrid nature was, however, later recognized by Dr. Brainerd, who also states that plants belonging to the same combination, have been collected by Dr. J. Fletcher at St. Stephen, N.B.[12]

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[11] Pittonia, vol. 5, p. 103.

[12] Rhodora, vol. 6, p. 220.

In the Geological Survey herbarium of Ottawa there is a specimen collected by Mr. J. M. Macoun at "Billings' Bush near Ottawa, May 18th, 1898," which puzzled the collector. It is mounted as No. 18761 with two specimens labelled *V. septentrionalis* Greene. The collector, however, was in doubt whether it should be referred to *V. septentrionalis*, and therefore wrote on one side of the specimen "*V. cucullata?*" In other words, the collector was in doubt as to whether it should be considered a form of *V. cucullata* or whether it should be referred to *V. septentrionalis.* In some respects it shows the characters of one of these species, in others it comes close to the other one.

There is no doubt, however, that the specimen in question represents a true hybrid between the species mentioned. The authors have had the opportunity to revisit the locality and have observed and collected many specimens of the hybrid, growing with their parent species.

V. cucullata x *septentrionalis*, as it occurs in the vicinity of Ottawa, reminds one at a superficial glance, very much of *V. cucullata.* It forms dense and very vigorous bunches and develops an abundance of beautiful sky-blue flowers which, like those of *V. cucullata* are borne on pedicels much surpassing the leaves and which, therefore, are very conspicuous. The exposed position of the flowers is, however, not the only thing which makes them so conspicuous. They are, in addition to being numerous and of a very rich colour, surprisingly large, in fact much larger than the flowers of either *V.cucullata* or *V. septentrionalis.*

A closer examination of the specimens collected reveals the fact that as far as their morphological characters are concerned, they represent undoubted itermediates between *V. cucullata* and *V. septentrionalis.* It is true that their pedicels are much longer than those of *V. septentrionalis*, but on the other hand they are decidedly shorter than those of *V. cucullata* and though soft and weak, are not slender as is the case with the pedicels of *V. cucullata.* The herbage of the hybrid plants differs from that of the glabrous *V. cucullata* in being very sparsely and obscurely hirtellous-hairy, and by the very same character from *V. septentrionalis*, which is rather conspicuously hairy, especially on the petioles.

The characters of the sepals in the hybrid are also intermediate between those of the parent species. In *V. cucullata* the sepals are perfectly glabrous, i.e., are not at all ciliolated along the margins, whereas the sepals of *V. septentrionalis* are strongly and very conspicuously ciliolated. In the hybrid the sepals have rather sparsely ciliolated margins.

The conclusive evidence showing beyond doubt that the plants are forms of neither *V. cucullata* nor *V. septentrionalis*, but hybrids between those species, is, however, furnished by the pollen. An examination of the same proves this without doubt. A large number of pollen grains are perfectly sterile, as a matter of fact not less than about 95 per cent, whereas pollen from specimens of *V. cucullata* and *V. septentrionalis*, collected with the hybrid, shows one hundred per cent perfect grains.

V. ? FIMBRIATULA X SEPTENTRIONALIS was collected at Charlottetown, P.E.I., by Mr. L. W. Watson.[13] As specimens of this hybrid have not been seen by the authors of the present paper, it will not be discussed here.

In the spring of 1913 the authors made a joint excursion to Chats Falls, Ont., situated on the Ottawa River, and only about 20 miles from the Capital. Among other interesting finds was a violet hybrid which is of special interest not only because it has not been recorded before from America, but also because the species from which it had been formed belonged to a group in which hybrids, so far, have never been observed on the American continent. The hybrid in question is

V. CONSPERSA RCHB. X ROSTRATA PURSH.

The occurrence of this hybrid in the Ottawa district is furthermore of interest, because *V. rostrata* is a comparatively rare plant in these latitudes. As a matter of fact, its occurrence at Chats Falls was a very agreeable surprise to the authors as so far, it had been recorded only from three localities in the vicinity of Ottawa. The occurrence of the hybrid between *V. rostrata* and *V. conspersa* was, as a matter of fact, less surprising than the occurrence of *V. rostrata* itself. The two species grew mixed together and blossomed at the same time. Consequently as hybrids between allied species of violets are very readily formed—a fact that is most emphatically demonstrated by the list of hybrids, given on previous pages—the discovery of the combination *V. conspersa* x *rostrata* was really only a matter of diligent search, it being quite a natural consequence of the parent species growing together.

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[13] Brainerd, Rhodora, vol. 6, p. 217.

The most conspicuous difference between *V. conspersa* and *V. rostrata* is, as is well known, that the spur of the former is less than 8 mm. long and comparatively stout, whereas the spur of the latter species is 10-12 mm. long and slender. The hybrid found at Chats Falls is characterized by having a spur the size and shape of which is just intermediate between those of the parent species. All other morphological characters, which it is hardly necessary to describe in detail, are also intermediate between those of *V. conspersa* and *V. rostrata* making it quite certain that the plants referred to are natural products of a spontaneous cross-fertilization between the species in question. That this really is the fact, is furthermore proven beyond doubt by the condition of the pollen as developed in its petaliferous flowers. Ninety-five to one hundred per cent of the pollen grains are imperfectly developed, shrunken, deformed and empty. Consequently they are sexually impotent and incapable of fertilizing the ovules of either the hybrid itself or of the parent plants.

What has been written must be considered as only an introduction to a more complete and detailed study of the genus *Viola* but it is hoped that enough has been said to encourage local botanists to undertake similar work in this genus within easy walking distance of their homes.

AUGUST BIRD LIFE AT PLEASANT POINT, ONT.*

By MELVILLE DALE.

During the past three summers it has been my privilege to spend part of the month of August at a little summer resort called Pleasant Point, situated on Sturgeon lake, some ten miles from Lindsay, and some seventy miles north-east of Toronto. The Lake is one of the Kawartha group and is part of the Trent Valley canal system. It is about fifteen miles long and from one to two miles wide. A dam at Bobcaygeon has raised the level of the lake to some extent, and formed a considerable area of "drowned land" at the mouth of the Scugog river. This marsh is composed of the usual growth of wild rice, bulrushes, pickerel weed, white and yellow pond lilies, etc., while many lagoons both large and small are found within its confines. In certain localities numerous stumps rise a foot or so above the water and form a favorite roosting place for the gulls, terns and herons.

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*Read before the McIlwraith Ornithological Club of London.

The land is quite rocky and the soil in the immediate vicinity of the lake poor. Farther back, however, the farms are excellent. The trees are the usual ones found in the north country, white birch, cedar, balsam, pine, maple, red and white oak predominating.

As already mentioned my observations have all been made during the month of August, so that the records kept include both summer residents and early fall migrants. In fact, if it were not for the small birds, particularly warblers, which arrive in great hosts about the middle of the month, August would be a rather unprofitable and uninteresting time for the bird student in this district.

From the camp at Pleasant Point, walks are taken up country in different directions for the study of land birds, while canoe trips are made to various points of interest along the lake shore or up the marsh. Probably the most interesting excursion of all is the one up the north arm of the lake in the direction of Fenelon Falls. About half way to the Falls a number of stumps are located along the west shore, some of them a few inches or a few feet above the water, others just below the surface far enough to make navigation dangerous in any but very calm weather. It was here the Caspian Tern was first observed in the summer of 1912. Identification was easy as the birds allowed a very close approach before taking flight, and even then they circled back and forth over the canoe, strongly voicing their displeasure at being molested. On August 22nd, 1914, a census was made of the birds found here, which showed Herring Gull 40, Ring-billed Gull 60, Caspian Tern 15. The difference in the color of the feet, even more readily than the difference in size, distinguishes the two gulls as they stand around on the stumps, but any differences which might be apparent then are immediately lost as the birds rise and fly screaming through the air.

The following list of species observed does not, of course, pretend to be a complete one, but will show to some extent the variety of birds to be found in this district.

PIED-BILLED GREBE, *Podilymbus podiceps*†—Common. Breeds in large numbers in the marsh.

LOON, *Gavia imber*—Tolerably common. Often seen disporting themselves in the lake in front of the camp.

HERRING GULL, *Larus argentatus*—Common.

RING-BILLED GULL, *Larus delawarensis*—Common. Above census would seem to indicate that they are more numerou than the Herring Gull.

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†Scientific names supplied by Associate Editor—P. A. T.

BONAPARTE GULL, *Larus philadelphia*—A small flock of ten or fifteen usually to be found during August, feeding in the middle of the lake.

CASPIAN TERN, *Sterna caspia*—This rare species is one of the notable birds of the lake. Their favorite roost seems to be the stumps half way to Fenelon Falls, but later they were discovered in similar stumpy areas in the marsh. They are also to be found fishing singly or in pairs up and down the lake, and may be distinguished from the gulls even at a distance, by the characteristic, down-pointing head and bill. The identification is made doubly sure when one drops into the water with a great splash to secure some luckless minnow.

BLACK TERN, *Hydrochelidon nigra surinamensis*—Fairly common. Breeds in the marsh. Early migrant. Nearly all gone by the middle of August.

BLACK DUCK, *Anas rubipes*—Flocks, sometimes numbering hundreds, seen in the marsh.

AMERICAN BITTERN, *Botaurus lentiginosus*—Common.

GREAT BLUE HERON, *Ardea herodias*—Very common.

GREEN HERON, *Butorides virescens virescens*—Along the river in the marsh. Somewhat rare.

VIRGINIA RAIL, *Rallus virginianus*—The only one observed was on August 19th, 1914, but no doubt there are numbers of them throughout the marsh.

SORA RAIL, *Porzana carolina*—Several records for this bird. Also no doubt quite common.

FLORIDA GALLINULE, *Gallinula galeata*—Very abundant. One of the most interesting birds of the marsh.

AMERICAN COOT, *Fulica americana*—A few seen each year. Not nearly as common as the Gallinule.

LEAST SANDPIPER, *Pisobia minutilla*—A small sandpiper observed from the deck of the steamer en route from Lindsay to the Point. It flew up as the boat approached and identification, of course, is not positive.

SOLITARY SANDPIPER, *Helodromas solitarius*—During the wet summer of 1912 several were noted alongshore and in a pool in a clearing in the woods. None seen in 1913 or 1914.

SPOTTED SANDPIPER, *Actitis macularius*—Common.

BLACK-BELLIED PLOVER, *Squatarola squatarola*—August 9th, 1912, one seen in a wet field three miles from the lake —a rather unusual place. Identified by the white rump and black patches under the wings.

KILLDEER, *Oxyechus vociferus*—Common.

RUFFED GROUSE, *Bonasa umbellus*—Found in swampy places.

MARSH HAWK, *Circus hudsonius*—Not very common.

SHARP-SHINNED HAWK, *Accipiter velox*—One seen some distance up country.

RED-TAILED HAWK, *Buteo borealis*—A pair bred in a big woods half a mile from camp.

SPARROW HAWK, *Falco sparverius*—A few seen up country.

OSPREY, *Pandion haliaetus carolinensis*—One fishing near Bobcaygeon, August 12th, 1912.

KINGFISHER, *Ceryle alcyon*—Very common.

HAIRY WOODPECKER, *Dryobates villosus*—Common.

DOWNY WOODPECKER, *Dryobates pubescens*—Common.

YELLOW-BELLIED SAPSUCKER, *Syphrapicus varius*—Rather numerous. Breeds.

RED-HEADED WOODPECKER, *Melanerpes erythrocephalus*—A number at the Point. Much more numerous up country.

FLICKER, *Colaptes auratus*—A few observed each summer. Not common.

NIGHTHAWK, *Chordeiles virginianus*—Flocks of fifteen or twenty seen during migrations.

CHIMNEY SWIFT, *Chætura pelagica*—A few always flying around.

HUMMINGBIRD, *Archilochus colubris*—One or two seen each year.

KINGBIRD, *Tyrannus tyrannus*—Quite common and as usual very noisy.

CRESTED FLYCATCHER, *Myiarchus crinitus*—To be seen or heard every day.

PHOEBE, *Sayornis phœbe*—Plasters nest under the rocky ledges in Fenelon river.

OLIVE-SIDED FLYCATCHER, *Nuttallornis borealis*—This rare species is one of the features of Pleasant Point bird life. It is quite a common breeder and may be seen almost any time of the day sitting on the top of some dead tree watching for passing insects.

WOOD PEWEE, *Myiochanes virens*—Heard calling from the deep woods.

ALDER FLYCATCHER, *Empidonax trailli alnorum*—Heard one calling from a swampy thicket.

LEAST FLYCATCHER—*Empidonax minimus*—Fairly common.

PRAIRIE HORNED LARK, *Octocoris alpestris praticola*—Found in fields a short distance from the lake.

BLUE JAY, *Cyanocitta cristata*—Only one or two seen each year.

CROW, *Corvus brachyrhynchus*—Ever present.

BOBOLINK, *Dolichonyx oryzivorus*—Found up country.

COWBIRD, *Molothrus ater*—Quite rare. Only two or three records covering the three years, one of them, unfortunately, being that of a young bird fed by a red-eyed vireo.

RED-WINGED BLACKBIRD, *Agelaius phœniceus*—Great flocks in the marsh.

MEADOWLARK, *Sternalla magna*—Not very common.

BALTIMORE ORIOLE, *Icterus galbula*, —Rather rare.

BRONZED GRACKLE, *Quiscalus quiscula æneus*—Quite numerous up country.

PURPLE FINCH, *Carpodacus purpureus*—Rather rare.

GOLDFINCH, *Astragalinus tristis*—Common everywhere.

VESPER SPARROW, *Poocætes gramineus*—A few along the roadside near the lake.

SAVANNAH SPARROW, *Passerculus sandwichensis savanna*—Not singing in August and therefore difficult to locate. Positively identified once, and suspected frequently.

WHITE-THROATED SPARROW, *Zonotrichia albicollis*—Common.

CHIPPING SPARROW, *Spizella passerina*—Common.

SLATE-COLORED JUNCO, *Junco hyemalis*—One might expect this sparrow to be common but only two or three seen each summer.

SONG SPARROW, *Melospiza melodia*—Common.

SWAMP SPARROW, *Melospiza georgiana*—Found in the marsh.

ROSE-BREASTED GROSBEAK, *Zamelodia ludoviciana*—Quite rare.

SCARLET TANAGER, *Piranga erythromelas*—Also rare.

PURPLE MARTIN, *Progne subis*—Heard near Fenelon Falls.

CLIFF SWALLOW, *Petrochelidon lunifrons*—Common.

BARN SWALLOW, *Hirundo erythrogaster*—Common.

TREE SWALLOW, *Iridoprocne bicolor*—Rather rare.

BANK SWALLOW, *Riparia riparia*—Common.

CEDAR WAXWING, *Bombycilla cedrorum*—Very common.

MIGRANT SHRIKE—*Lanius ludovicianus migrans*—Quite common up country.

RED-EYED VIREO, *Vireosylva olivacea*—Very common.

BLACK AND WHITE WARBLER, *Mniotilta varia*—Probably the most numerous warbler.

NASHVILLE WARBLER, *Vermivora rubricapilla*—A few seen each year.

TENNESSEE WARBLER, *Vermivora peregrina*—August 21st, 1914, one seen.

PARULA WARBLER, *Compsothlypis americana*—A number seen each year.

CAPE MAY WARBLER, *Dendroica tigrina*—1914 the first year this bird was recorded. Twelve seen in one day.

YELLOW WARBLER, *Dendroica æstiva*—A few seem to breed in this locality, but not at all common,.

BLACK-THROATED BLUE WARBLER, *Dendroica cærulescens*—Also breeds in small numbers.

MYRTLE WARBLER, *Dendroica coronata*—Common.

MAGNOLIA WARBLER, *Dendroica magnolia*—Quite a common migrant.

CHESTNUT-SIDED WARBLER, *Dendroica pensylvanica*—Common.

BAY-BREASTED WARBLER, *Dendroica castanea*—Common during migrations.

BLACKPOOL WARBLER, *Dendroica striata*—August 21st, 1914, one seen.

BLACKBURNIAN WARBLER, *Dendroica fusca*—Very common during migrations.

BLACK-THROATED GREEN WARBLER, *Dendroica virens*—Very common.

OVEN-BIRD—*Seiurus aurocapillus*—Common.

WATER-THRUSH, *Seiurus noveboracensis*—Numbers breed in the swampy places. In August they may be seen feeding in the open along the shore among the drift wood and other debris.

MOURNING WARBLER, *Oporornis philadelphia*—Keeps to the swampy thickets and rarely seen in August.

MARYLAND YELLOWTHROAT, *Geothlypis trichas*—Quite a common bird.

WILSON WARBLER, *Wilsonia pusilla*—August 19th, 1914, adult male seen. Only record.

CANADIAN WARBLER, *Wilsonia canadensis*—Common, especially during migrations.

AMERICAN REDSTART, *Setophaga ruticilla*—Very common.

CATBIRD, *Dumetella carolinensis*—Common.

HOUSE WREN, *Troglodytes aedon*—Fairly common.

WINTER WREN, *Nannus hiemalis*—Nests in swampy places. Not singing in August and therefore hard to find.

LONG-BILLED MARSH WREN, *Telmatodytes palustris*—Abundant in the marsh. Their nests are to be found all over, and the birds scold the intruder as his canoe is pushed among the reeds.

BROWN CREEPER, *Certhia familiaris*—Only one or two observed.

WHITE-BREASTED NUTHATCH, *Sitta carolinensis*—Very common.

RED-BREASTED NUTHATCH, *Sitta canadensis*—A few seen each year. Breeds.

BLACK-CAPPED CHICKADEE, *Penthestes atricapillus*—Around the camp all the time.

RUBY-CROWNED KINGLET, *Regulus calendula*—One or two seen in 1912.

VEERY, *Hylocichla fuscescens*—Common.

ROBIN, *Planesticus migratorius*—Common.

BLUEBIRD, *Sialia sialis*—A number seen each year.

The discovery of this bird and its use of the Trent Valley as a migration route adds considerably to our knowledge of its distribution in Canada. About five years ago Mr. John Firth, Durham, was authority for the statement made to Mr. W. E. Saunders, that a mounted specimen in his collection came from an island near Parry Sound "where they were breeding." Mr. Saunders had no opportunity of investigating this matter for himself but at his request, Mr. Guy A. Bailey of Geneseo, N.Y., went to Parry Sound about 1911 to investigate the matter and found, sure enough, that the bird nested in considerable numbers on at least one of the islands in that district. He returned with photographs of the eggs and young.

Prior to this discovery the only place where these birds were known to nest in the Great Lakes was a little cluster of islands in Lake Michigan and now, following the addition of this bird to the Canadian breeding list comes this definition of its migration route.

This bird is seen in both spring and fall migrations on Lakes Huron, St. Clair, Erie and Ontario, but nowhere has it been reported in anything like the numbers that have been seen on Sturgeon lake.

Mr. Saunders and his friends, who make such frequent visits to Point Pelee, have always found this species to be rare; and its size, coupled with its peculiar call, almost dog-like in tone, together with the fact that Terns are usually noisy, renders it likely that very few pass unnoticed within the range of the observer.

BOOK NOTICE.

NERVES—By Professor D. Fraser Harris, M.D., D.Sc., F.R.S.E., Etc., Professor of Physiology, Dalhousie University, Halifax, N. S.

This most admirable handbook on "Nerves" belongs to that excellent series, "The Home University Library of Modern Knowledge," published by Williams and Norgate, London. The series ranges over such diverse fields as Literature, Art, History, Philosophy and Science, and the authors include some of the most eminent specialists of our time. Professor Fraser Harris's little treatise of nearly 250 pages will rank among the best, for it is brightly written, full of interesting matter, thoroughly up to date, and as clear and concise as could be desired. The book has a distinct literary flavour, as might be expected from a writer who has the distinction of being a member of the exclusive "Authors Club" of London.

Nobody, in these days of stress and strain, needs to be told that he possesses nerves. Most people are only too painfully aware of the fact, and like James David Forbes, the Scottish physicist, compelled to confess "I am laid on my back, and unable to revolve through the smallest aliquot parts of a right angle without a tremendous twitch."

A clearer description of the nerves, and of nerve functions, than Dr. Fraser Harris gives in his first two chapters cannot, we feel sure, be found, though a few good figures of the brain, spinal cord, and of actual preparations, not diagrammatic, would have been helpful to ordinary readers. Many curious facts are detailed in the earlier chapters, such as the ascertained speed of nerve impulses, viz.: 180 feet per second in man's motor nerves. These nerve impulses are not the same as electrical waves, though all neural activity, as of all muscular activity, is accompanied by electrical disturbances. The continuity of the neuraxone is carefully explained and in Chap. III the nature of nerve centres, or specialized groups of nerve cells, are admirably elucidated. The nerve centres are a "hierarchy," the lower centres obey the higher, says the author, there is no equality, but there is co-operation, surely an object-lesson for some politicians! Curiously enough nerve activities are not specific for experiment shows that a nerve for inhibiting the heart was grafted on to the nerve for dilating the pupil of the eye, and on being stimulated the heart-nerve actually dilated the pupil (p. 78). The character of nerve activity depends upon the tissue or organ in which the nerve ends. Habit or the forming of nerve-paths, individual susceptibility or the truth that "what is one man's meat is another's poison," and other interesting topics are all admirably treated. The importance of inhibition is revealed, and the most recent views on fatigue, sleep, and nerve restoration, set forth. Professor Fraser Harris's views on sleep attracted wide attention, when he delivered his remarkable Midland Institute lecture, in Birmingham, some years ago. It is here shown that sleep results normally from a kind of poisoning of the brain cells, decreased brain circulation, and diminished sensation. Sleep may be prevented by too energetic brain circulation, excessive mental occupation, etc., and the paragraphs are most valuable upon the causes of "insomnia," that dread calamity, which is well-nigh the worst of human ills. The author gives some curious examples of sleep under difficult circumstances, but these are even surpassed by the recorded instance of a naval captain during the last attack on Rangoon (in the Indian Mutiny), when, worn out by constant overstrain, he fell into a deep sleep on deck, and slept for two hours though he lay within a yard of one of the largest guns, which was being energetically fired the whole time. The author does not shrink from postulating a "nerve force" as a scientific fact, in spite of its psychological and metaphysical dangers, and he declares that our nervous system is "dynamogenic." The tremendous muscular power of maniacs, must be attributed to abnormal production of such nerve force. In Chap. IX on "Nervousness" Dr. Harris describes the Nissl granules. In the cell rested and fresh the granules are well-formed, but in overworked cells they become irregular and indistinct, hence they must be the physico-chemical basis of nerve energy. Gland cells are similarly crammed with minute granules in the rested condition, but are deficient in granules after active glandular secretion. High phosphorus (lecithin) is beneficial for nerves in a starved, fatigued condition, and fatty food, under proper conditions, is valuable. The pages on fussiness, irritability or "bad temper," neurasthenia and other troubles are scientifically described. Bodily health and nerve health are vitally connected, and the power of inhibition is a supreme blessing, this power of control being the expression of nerve vigour, it is "Knowing when and where to stop, when not to act and not to speak."

A useful glossary of terms, and a brief bibliography of "nerve" books, and a very concise index complete a model guide upon a subject of universal interest. Professor Harris is, we notice, the only Canadian author who has written a book for this "Home University" Series, which the London "Daily Telegraph" affirms gives "the world's learning in little."

E. E. P.

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